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LOCAL GOVERNMENT BOARD FOR IRELAND.

REPORT

ON THE

SHELL-FISH LAYINGS ON THE IRISH COAST,

AS RESPECTS

THEIR LIABILITY TO SEWAGE CONTAMINATION.

Presented to both Houses of Parliament by Command of His Majesty.



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TO HIS EXCELLENCY WILLIAM HUMBLE, EARL OF DUDLEY,

LORD LIEUTENANT-GENERAL AND GENERAL GOVERNOR OF IRELAND.

MAY IT PLEASE YOUR EXCELLENCY:—

We, the Local Government Board for Ireland, herewith submit to Your Excellency a Report, from a sanitary point of view, upon the conditions under which certain forms of edible shell-fish are cultivated on the coasts of Ireland.

Some recent outbreaks of Enteric Fever in England, together with a number of cases of the disease in this country which came under the notice of our Medical Staff, having been apparently caused by the eating of oysters, we deemed it advisable, in view of the danger arising to the public health, to direct an Inquiry into the general question of the pollution by sewage of the foreshores and river estuaries from which shell-fish, notably oysters, cockles, and mussels, are sent to market. We did not, however, deem it necessary to extend the Inquiry to the question of whether such diseases as Enteric Fever and Diarrhœa are, or are not, communicable through the medium of specifically polluted shell-fish, for we consider the certainty that such diseases are so communicable is now fully admitted.

We accordingly instructed our Medical Inspector, Dr. T. J. Browne, to visit the several shell-fish layings on the Irish littoral, to examine the local surroundings in each case with special reference to the possibility of sewage contamination, and to report to us the result of his investigations. Our detailed letter of instructions is appended, and it will be seen therefrom that we also directed him to obtain and forward samples of the shell-fish to our Bacteriologist, Professor McWeeney, for bacterioscopic examination. We arranged, however, that each should pursue his investigations independently, *i.e.*, that Dr. Browne should form his opinion, after personal inspection, of the possible existence or non-existence of sewage contamination, without knowledge of the results of the bacterioscopic examination of any samples sent by him to Professor McWeeney, and that the latter gentleman, in making his examination of the samples, should not have any knowledge of the conclusions which Dr. Browne might have arrived at.

The Report, which we have now the honour to submit, is divided into two parts or sections—one, containing the several reports made to us by Dr. Browne, and the other, those made by Professor McWeeney.

It will be observed that Dr. Browne has made a complete topographical survey of the various bays, harbours, and estuaries on the shores of which shell-fish are cultivated, and that in each case, besides giving a general description of the laying, he furnishes a map showing its situation, and also the position of any sewer outfalls in the neighbourhood. As the result of his investigations it will be seen that he finds himself able roughly to classify the various layings, beds, &c., in Ireland as follows:—

- I. those which are apparently *free* from pollution;
- II. those the purity of which must be regarded as *doubtful*.
- III. those which appear to be undoubtedly *contaminated*.

Although Dr. Browne's inquiries cover the whole ground, the work had necessarily to be done in a short time, and it must not be assumed that we regard it as anything more than a superficial examination of the various

foreshores in so far as they seem to be affected by sewage contamination. To enable us to distinguish conclusively the layings which may be regarded as reasonably safe from those which are not, far more prolonged investigations by both Dr. Browne and Professor McWeeney would be required than time and the pressure of other work has, so far, permitted. The Report must, therefore, so far as it goes, be taken as merely enabling us to distinguish those layings which seem to be pure from those believed to be grossly polluted, and as indicating the necessity for a closer study of the conditions obtaining at a large number of layings which must, on the strength of the investigations now submitted, be regarded, provisionally, as of doubtful character. That these latter are possibly somewhat more numerous than Dr. Browne anticipated from his local inspection, will be seen from Professor McWeeney's report upon the bacterioscopic examination of the samples forwarded to him.

Professor McWeeney's report may be divided into two sections. In the first, which is in the nature of a preliminary report, he gives a full account of the methods he employed in his laboratory experiments, and in the second, besides summarising in a general form the results obtained on examination of the samples taken from each bed or group of beds around the coast, he furnishes tabulated statements showing in detail the result of his examination as regards *each* of the samples of shell-fish, water, and mud taken from the beds. It will be seen that, as a general rule, he tested the specimens for *B. coli communis* and *B. enteritidis sporogenes*, and the tabulated statement readily indicates by the presence of the sign *plus* + or *minus* - whether the organism tested for was, or was not, found in the amount of material submitted to examination. Professor McWeeney also furnishes us with a number of photographs in illustration of the results arrived at. Although, as stated, he tested in each case for *B. enteritidis sporogenes*, as well as for *B. coli communis*, it will be noted that he takes the presence or absence of the *Bacillus coli communis* in one cubic centimetre of the samples of shell-fish and water taken from the laying as the test of pollution by sewage matter. Professor McWeeney's standard of purity is one which, if applied to a drinking-water, would lead to its condemnation as unfit for use; he is, however, careful to point out the very wide distribution in nature of *B. coli*, and the necessity in doubtful cases of making an estimate of the number of *Coli bacilli* before assuming that the pollution is of a very grave character.

It is possible that layings which may be regarded as practically pure may be found to contain small numbers of *B. coli*, and that it may not be unusual to discover this organism in the shell-fish, water, or sand in such layings. It is, therefore, perhaps desirable that in addition to the *presence* of the bacilli even in one cubic centimetre of the samples examined, an *enumeration* should be made, and that the question of danger to health should be estimated, so far as the Bacteriologist is concerned, by the numerical abundance of the organism found to be present after repeated examinations. Although there may be potential danger to health where *Coli* is ascertained to be present, even in quantities up to 100 cubic centimetres, we must, nevertheless, be careful not to overestimate a danger which, owing to many and varying circumstances, it is impossible at present to gauge. A moderate view of the question would appear to be that the presence either in food or water of the *Bacillus coli*, which is a habitant of the intestines of men and animals, must be regarded as a danger signal and warning, which increases in gravity according as it is found both in *numerous* samples and in *large numbers*, as it goes to show that the specific bacillus of such diseases as Enteric Fever may, under certain circumstances, also be present, and that the absence of the *Bacillus coli* may, to some extent, reassure us as its abundance is undoubtedly much greater than that of the Typhoid Bacillus, and its vitality is also much greater. At the same time we think it right to state that in our opinion bacterioscopic or chemical examinations of samples taken from shell-fish layings cannot be regarded as a substitute for careful and intelligent local inspection, but rather as an

aid in all but obvious cases of pollution. Where, therefore, Professor McWeeney's results differ, as they do in some instances, from the conclusions arrived at by Dr. Browne, it must not be assumed that Dr. Browne's conclusion is necessarily erroneous, or that because the Bacteriologist has been able to isolate the *Coli bacillus* in one or more samples taken from a particular laying, the shell-fish of this laying are *de facto* dangerous to man. Still less must it be inferred that the molluscs are not subject to contamination in certain cases, such as Carlingford Lough, where gross pollution seemed evident on personal inspection, and where we had the further evidence that Enteric Fever had from time to time been attributed to the consumption of oysters taken from the shores of the Lough, but where *Coli* has not been discovered in the samples taken from some of the beds. The failure to isolate the bacillus in one cubic centimetre of the sample must be regarded as a purely negative result, and not as proof of its non-existence, particularly where comparatively few samples have been examined. In both cases, further, and possibly prolonged, local and scientific investigation is requisite in order, so far as possible, to gauge the amount of danger to which the shell-fish are exposed in existing conditions.*

Although there are divergences of opinion in some instances, it will be observed from a close study of the Report, that the results of the laboratory investigations on the whole very closely coincide with the conclusions arrived at after local inspection, and that, for the most part, Dr. Browne and Professor McWeeney are substantially in agreement. When it is considered that Professor McWeeney, as already stated, made his investigations unaware of Dr. Browne's views as to the possibility of contamination of the layings from which samples were submitted, and without any knowledge of local circumstances (except in the case of Dublin Bay), their joint opinion as to the pollution of certain layings will scarcely be disputed.

Possibly, in some instances where pollution is not great, it may be easy to divert the sewage into other channels, and in others to treat it in such a manner as to render it innocuous. Short, however, of the sterilisation of sewage effluents discharging in the immediate vicinity of shell-fish beds, no other form of treatment at present in use is likely to be effectual in destroying or removing, although it may succeed in reducing, the number of pathogenic germs. It may, perhaps, be found possible in certain instances where the layings are not grossly polluted, and where molluscs thrive exceptionally well, to remove the shell-fish to pure waters for a period of quarantine not shorter than the known life of *B. coli*, in such media as sea-water, brackish-water, sand, mud, and the bodies of molluscs, in the last-mentioned of which bodies it is possible that *B. coli* persists for a prolonged period. Whether this course would sufficiently meet the requirements of the case is a matter for further investigation, but it is doubtful whether it would be likely to commend itself to consumers of shell-fish, as, apart from the question of disease, it must be highly repugnant to use, as an article of food, shell-fish which have been subject antecedently to faecal pollution.

The result of the investigation now made shows clearly that shell-fish are at present laid in some places on the Irish coast which are grossly polluted, and that there is a comparatively large number of layings the purity of which is open to doubt. From the figures given by Dr. Browne as to the quantities of the different kinds of shell-fish sold annually from layings in Ireland, it will be seen that the extent of the industry is considerable, and there is, therefore, all the more danger of shell-fish from polluted or doubtful sources finding their way into the markets.

* See Appendix, pp. 142 to 148. It will be seen that in the cases referred to the results of some further investigations by the Bacteriologist confirm the opinion arrived at after local inspection.

As the law at present stands, there does not appear to be any adequate means of protecting the public against the sale of polluted shell-fish. Unlike other forms of food which, on account of their external appearances may be seized and condemned by the Sanitary Inspector, shell-fish, unless they are decomposed, cannot be dealt with, as there are no obvious external signs by which it can be determined whether they are capable of producing disease or not, and although the Sanitary Inspector may know that they have come from polluted layings, he has no evidence upon which he would be justified in seizing a particular consignment, nor, if he did so, any ready means of proving that the shell-fish are unfit for human food. In this sense, even bacteriological testing is a relative, not an absolute, criterion, of danger, in the absence of isolation of specific human-disease-producing microbes.

We think that in the interests of the public health, the whole question of the cultivation and sale of shell-fish is one which calls for special legislation. The facts brought to light in the accompanying Report seem to us forcibly to demonstrate the necessity, from the public health point of view, of having some responsible authority which could provide for the registration and supervision of all layings, and prevent the sale of shell-fish from those which may be shown to be dangerously polluted. Even if legislation resulted in the closing of contaminated layings, such as those in the estuaries of the Liffey and Lagan and the Newry River, it stands out conspicuously in the Report that there is available in this country a great stretch of coast-line with numerous bays and estuaries which, so far as freedom from sewage pollution is concerned, are ideal situations for the cultivation of shell-fish. The industry would, therefore, only be transferred to larger and purer sources in the West and South coasts of Ireland, where there is, apparently, almost illimitable scope for its extension under suitable hygienic conditions.

In conclusion, we desire to state that the work of our Inspector in connection with this investigation was greatly facilitated by the Fisheries Branch of the Department of Agriculture and Technical Instruction for Ireland, and particularly by the information supplied to him by Mr. E. W. L. Holt, Scientific Adviser to the Branch.

We have the honour to be,

Your Excellency's obedient Servants,

H. A. ROBINSON.

T. J. STAFFORD.

Local Government Board,

Dublin,

October, 1903.

LETTER OF INSTRUCTIONS ADDRESSED BY THE LOCAL
GOVERNMENT BOARD FOR IRELAND TO THEIR MEDICAL
INSPECTOR, DOCTOR THOMAS J. BROWNE.

LOCAL GOVERNMENT BOARD,

DUBLIN, *11th February*, 1903.

SIR,

In consequence of the outbreaks of enteric fever and other illness, which have occurred from time to time of late years in different parts of the United Kingdom, and which have been attributed to the consumption of oysters, cockles, or mussels, which have been exposed to pollution by sewage, the Local Government Board for Ireland are anxious to ascertain particulars with regard to the distribution, methods of culture, and preparation for markets, of shell-fish on the Irish littoral, and they have therefore to request that you will be good enough to make inquiry into the subject, and furnish them with a report as to the result of your investigations.

The following are the principal points on which the Board desire to be furnished with information:—

- i. Name of Urban or Rural District.
- ii. Name of place where natural beds exist, or oysters are laid down.
- iii. Situation of beds, or layings, having regard to distance from the shore, and proximity to the outfall of any sewer or drain.
- iv. Your opinion as to the liability of the beds to contamination from untreated or treated sewage. In the case of a treated sewage, please state method of treatment adopted.
- v. What steps, if any, are taken to prevent contamination of the beds, or layings, and to ensure that shell-fish should be reasonably free from risk of sewage pollution.
- vi. If oysters are raised from spat, or merely laid down to “fatten”; and, in the latter case, the locality from which they are brought, and the average length of their sojourn on the layings referred to, should be ascertained and stated.
- vii. Means of storage of oysters, whether in beds, ponds, pits, or otherwise—localities and receptacles in which oysters are placed in preparation for, and pending, distribution to market for immediate consumption.
- viii. The extent of the industry, including the names of the persons having control, the number of men employed, &c.
- ix. Names of places to which the shell-fish are sent for consumption, or sale, and where possible a description of the treatment to which they are subjected from the time they are despatched until they are consumed.
- x. The beds, layings, ponds, &c., which you consider are kept in a cleanly state, as distinguished from those not so kept, and the direct cause of contamination in the latter case.
- xi. Similar information with regard to cockles and other shell-fish.

The Board would be glad if, in certain cases where you regard the layings as liable to pollution, you would obtain samples of the shell-fish and of the water in which they are laid and submit them to Professor McWeeney, the Board's Bacteriologist, for examination.

The samples of water for bacteriological examination should be collected in properly sterilised bottles, which will be supplied on request from the Bacteriological Laboratory, and the exact state of the tide at the time of the collection of the samples—whether on the ebb or flow—should be carefully recorded. The date and time of collection of the samples should be recorded upon the label, and the samples should be despatched at once in the most expeditious fashion—Professor McWeeney being advised by telegram of such despatch.

In all cases it is desirable to furnish maps, or photographs, showing the beds, layings, or pits, in their relation to sewers or other sources of pollution.

In any recommendations which you may think it advisable to make, the Board would be glad if you dealt separately with the various kinds of shell-fish.

A report at an early date is desirable.

I am,

Sir,

Your obedient Servant,

A. R. BARLAS,

Assistant Secretary.

N.B.—Samples should not be sent to the Bacteriologist at the end of the week.

REPORT

ON AN

INQUIRY INTO THE CONDITIONS UNDER WHICH OYSTERS
AND CERTAIN OTHER EDIBLE MOLLUSCS ARE
CULTIVATED AND STORED ON THE COAST OF IRELAND,
WITH SPECIAL REFERENCE TO THE QUESTION OF THE
POLLUTION OF THE SHELL-FISH LAYINGS BY SEWAGE
MATTER.

BY

DR. T. J. BROWNE

(Medical Inspector of the Local Government Board for Ireland).



MAP

OF

COAST-LINE OF IRELAND

SHOWING, APPROXIMATELY,
THE POSITIONS OF THE VARIOUS
SHELL-FISH LAYINGS.



INTRODUCTORY OBSERVATIONS.

The Inquiry was ordered by the Local Government Board for Ireland in consequence of the frequent outbreaks of Enteric Fever and other illness which have occurred of late years in different parts of the United Kingdom, and which have been attributed to the consumption of oysters, cockles, or mussels which have been exposed to pollution by sewage.

The principal points on which the Board desired to be furnished with information are set forth in their detailed letter of instructions addressed to me on the 11th February, 1903, a copy of which is prefixed to this Report.

In accordance with these instructions, I proceeded forthwith to obtain the information desired, and in submitting this report I desire to state that the results of Professor McWeeney's examination of the shell-fish, &c., have not been communicated to me, so that my conclusions as to pollution or otherwise of the different localities or places from which shell-fish are obtained are based entirely on the physical circumstances of each place and their topographical relations to the outlets of local sewers and drains having regard to the nature and composition of the effluents.

The samples of oysters and other shell-fish, as also of the water and ground formation from the different beds, &c., were all obtained at or near low water, and under conditions the most unfavourable as to freedom from pollution if such were present. The specimens of water and ground formation were taken in sterilized bottles, the samples of oysters and other kinds of shell-fish were packed in clean boxes with seaweed taken from the same places, and all were forwarded by Parcels Post on the same day on which they were taken, addressed to Professor McWeeney's Laboratory, Cecilia-street, Dublin, where, I am informed, they arrived in good condition on the following morning. It will be noted that every precaution was taken to guard against possible contamination from extraneous sources, and to present the specimens for examination with the least possible delay after being taken.

Owing to unfavourable weather conditions, the state of the tides, and the necessity for expedition in completing the inquiry, it was necessary to entrust the taking of specimens in some instances to the local Medical Officers of Health or members of the Royal Irish Constabulary, to whom I am indebted for the careful manner in which they carried out my instructions.

In the cases of the deep sea oyster fisheries off the coast of Wicklow and Wexford, I am under obligations to the Fisheries Branch of the Department of Agriculture and Technical Instruction for kindly placing at my disposal the S.S. "*Helga*" for dredging operations, which otherwise would have proved difficult to accomplish. I have also to thank Mr. E. W. L. Holt, Scientific Adviser to the Fisheries Branch of the Department, for the very material assistance he rendered me at the outset of this inquiry in furnishing me with information as to the situation, &c., of oyster beds around the coast

Maps showing the situation approximately of the several oyster beds, and of the places from which mussels and cockles are taken, and the relative positions of the sewer and drain outfalls, accompany this report.

*GENERAL STATEMENT AS TO THE SHELL-FISH LAYINGS
ON THE IRISH LITTORAL.*

The Inquiry was commenced with the oyster fisheries in the estuary of the River Lee and other rivers entering Cork Harbour, and was continued round the south, west, north, and east coasts of Ireland.

The localities visited in the course of the Inquiry are as follows:—

County.	District.	County.	District.
Co. Cork, .	Estuaries of Lee, Douglas, Ballinacurra and Carrigaline Rivers (Cork Harbour.) Youghal Harbour. Ballycotton Bay. Estuary of Bandon River, Kinsale Harbour. Courtnacsherry Harbour. Clonakilty Bay. Glandore Harbour. Estuary of River Ilea. Roaring Water Bay. Bantry Bay.	Co. Mayo, .	Fahy Bay. Little Killary Bay. Killary Bay. Clew Bay. Newport Bay. Achill Sound. Achill Island. Bellacragher Bay. Blacksod Bay. Broadhaven Bay. Killala Bay.
Co. Kerry, .	Estuary of Kenmare River. Castlemaine Harbour. Tralee Bay. Barrow Harbour. Carrig Island. Tarbert Roads.	Co. Sligo, .	Ballysodare Bay. Sligo Bay. Drumcliffe Bay.
Co. Limerick and Co. Clare.	River Shannon.	Co. Donegal, .	Lough Swilly.
Co. Clare, .	Pooldoody Bay. Poolnacloough Bay.	Co. Londonderry,	Lough Foyle.
Co. Galway, .	Kinvarra Bay. Pollagh. Tyrone Bay. Estuary of Kilcolgan River. Ballinacourty Harbour. Ardfry Bay. Oranmore Bay. Galway Bay, Estuary of River Corrib. Kilkieran Bay. Birterbuy Bay. Cashel Bay. Clifden Bay. Ardbear Bay. Mannin Bay. Ballinakill Bay. Barnaderg Bay.	Co. Antrim, .	Belfast Lough.
		Co. Down, .	Strangford Lough. Dundrum Bay.
		Co. Louth, .	Carlingford Lough. Dundalk Bay. Drogheda—Estuary of River Boyne.
		Co. Dublin, .	Malahide Inlet. Portmarnock Inlet. Dublin Bay.
		Co. Wicklow, .	Broad Lough. Brittas Bay. Arklow Bay. St. George's Channel.
		Co. Wexford, .	Ballyvalden Oyster Fisheries. Wexford Harbour.
		Co. Waterford .	Waterford Harbour.

CLASSIFICATION OF OYSTER FISHERIES.

- I.—Public or Natural Oyster Fisheries.
- II.—Chartered Oyster Beds.
- III.—Licensed Oyster Beds.
- IV.—Unlicensed Oyster Beds

Public Oyster Fisheries are located as follows :—

County.	District.	County.	District.
Co. Cork,	{ Estuary of River Lee. Estuary of River Ballinacurra. Estuary of Carrigaline River. North Channel. Rostellan. Estuary of Bandon River, Kinsale Harbour. Glandore Bay. River Ilen. Roaringwater Bay.	Co. Mayo,	Clew Bay. Blacksod Bay.
		Co. Donegal,	Lough Swilly.
		Co. Londonderry,	Lough Foyle.
		Co. Antrim,	Belfast Lough.
		Co. Louth,	Carlingford Lough.
Co. Kerry,	{ Kenmare River. Tralee Bay.	Cos. Wicklow and Wexford.	St. George's Channel.
[Cos. Limerick and Clare.	River Shannon.		
Co. Galway,	{ Kinvarra Bay. Tyrone Bay. Estuary of River Corrib. Fahy Bay. Killary Bay.		

Of the foregoing, the productive fisheries in order of importance are as follows :—

Tralee Bay.
Carlingford Lough, Estuary of Newry River.
Galway Bay (Kinvarra Bay and Tyrone Bay beds).
Cork Harbour, Estuary of River Lee.
Wexford, St. George's Channel beds.
Lough Foyle.

The remaining public oyster fisheries are of little importance as sources of supply, the outputs being small.

The close season for the fisheries varies from five to eleven months of the year.

The oysters taken from the public beds are chiefly disposed of for laying on private oyster beds on the coast of Ireland, for growing and fattening purposes. The larger and marketable oysters, which form a small proportion of the whole, are disposed of locally and to oyster merchants for immediate consumption. The total annual output of oysters from public fisheries would amount to about 6,000,000.

CHARTERED OYSTER BEDS OR LAYINGS.

These are situate as follows :—

Sutton Creek and Clontarf—Dublin Bay.
Foaty Channel—Cork Harbour.
Sneem Harbour—Kenmare River.
Kilmakilloge Harbour—Kenmare River.
Kilkieran Bay.
Cashel Bay.
Birterbuy Bay.
Malahide Inlet.

Of the above, the only fishery which stocks itself is the one in Kilkieran Bay. The others are used for laying down native oysters for growing and fattening, with the exception of the bed in Sneem Harbour, which is not worked at present, and the beds at Sutton Creek, Clontarf, and Malahide, which are used for storing or laying down American oysters, pending sale during the summer months, when native oysters are not in season. The total annual output of native oysters from chartered beds would amount to about 1,000,000, and of American oysters from the beds at Sutton Creek, Clontarf, and Malahide, about 25,000,000. The latter are sent chiefly to the Liverpool and Manchester markets, where they are disposed of at a cheap rate for immediate consumption, many finding their way to seaside resorts, such as the Isle of Man, Blackpool, &c., &c.

The native oysters are sent in small consignments to merchants and private customers in various parts of England, Scotland, and Ireland, and command a much higher price.

LICENSED OYSTER BEDS AND LAYINGS.

There are sixty-two licensed oyster beds, or rather layings, on the coast of Ireland. With few exceptions these beds are stocked or cultivated only to a small extent, and several are practically derelict. Those which are cultivated to the greatest extent are the Ardagh Oyster Fishery, Clifden, County Galway, the annual output from which is about 250,000 native oysters; Ardfry Oyster Fishery, County Galway, output, 200,000 native oysters; Barrow Harbour Fishery, 177,000 native oysters; Burrén Oyster Fishery, 150,000 native oysters; Pollagh Oyster Fishery, 150,000 native oysters; Oyster Island, Sligo Bay Fishery, 100,000 native oysters. Other oyster layings yield from 500 to 50,000 annually—total annual output of native oysters from licensed beds, about 2,000,000. Two of the licensed oyster layings are stocked with American oysters, viz.:—Mussen and Co.'s.

Carlingford Lough, annual output about 5,000,000, and Cooper's layings in Ballysodare Bay, annual output about 50,000.

The native oysters are disposed of to merchants in the large cities and towns in England, Scotland, and Ireland, and to private customers. The American oysters are sent chiefly to the Liverpool and Manchester markets, and some disposed of in Dublin and other places.

UNLICENSED OYSTER LAYINGS.

There are three unlicensed oyster layings in Carlingford Lough, viz.:—Petrie's, McDonald's, and Hardy's; two in Galway Bay, Neilan's and Lenehan's; one in the estuary of Ballinacurra River, Cork Harbour (Olden's); and one at the head of Broadhaven Bay, close to Belmullet, County of Mayo.

The layings in Carlingford Lough and estuary of Newry River are used for American oysters. The number laid down annually is about 6,000,000. These oysters are laid down in the months of March and April, and taken up from May till end of September, and sent to Liverpool and Manchester markets. Some are disposed of locally and in Dublin. The unlicensed oyster layings in Cork Harbour and Galway Bay are utilised merely for the purpose of storing native oysters procured from the local fishermen pending sale, and are owned by local dealers. The output of oysters from these layings would amount to about 200,000 annually. They are disposed of chiefly in the Dublin and Cork markets.

CLASSIFICATION OF LAYINGS HAVING REGARD TO POSSIBLE POLLUTION.

As regards pollution, the following classification of oyster layings, &c., may be made:—

- (1.) Those which are apparently *free* from pollution;
- (2.) Those the purity of which must be regarded as *doubtful*;
- (3.) Those which appear to be undoubtedly *contaminated*.

The oyster layings, &c., which, in my opinion, are apparently free from pollution, are situate as follows, viz.:—In Roaringwater Bay; Barrow Harbour; River Shannon; Galway Bay (with the exception of the public fishery close to the mouth of River Corrib); Kilkieran Bay; Birterbuy and Cashel Bays; Ardbear and Mannin Bays; Ballinakill Bay and inlets; Little Killary Bay; Killary Bay (except the fisheries close to the village of Leenane); Clew Bay; Newport Bay; Achill Island and Sound; Blacksod Bay (with the exception of public fishery and layings close to town of Belmullet); Ballysodare Bay; Drumcliffe Bay; Lough Swilly; and the deep sea fisheries in St. George's Channel.

The layings, &c., which I consider are doubtful as regards freedom from pollution, are situate as follows:—Foaty Channel; Cairigaline River; Ballinacurra River; North Channel; and Rostellan in Cork Harbour; Estuary of Bandon River (Kinsale Harbour); Ilan River; Glandore Harbour; Kenmare River; Tralee Bay Public Oyster Fishery; Clifden Bay; Killary Bay; public fisheries close to Lenane; Killala Bay; Oyster Island (Sligo Bay); Lough Foyle and Malahide inlet.

The layings, &c., which, in my opinion, are more or less subject to pollution by sewage, owing to proximity to sewer outfalls, are situate as follows:—

Public Oyster Fishery, Estuary of the River Lee, Cork Harbour; Public Oyster Fishery close to mouth of River Corrib, Galway Bay; Public Fishery close to town of Belmullet, and layings in same locality; Nos. 99 and 100, licensed oyster beds, Sligo Bay; Belfast Lough public oyster fisheries; Carlingford Lough and Estuary of Newry River public oyster fisheries and private layings; and layings in Dublin Bay.

It will be noted that some of the principal sources of supply are not free from suspicion of contamination by sewage effluents.

SHELL-FISH AND ENTERIC FEVER.

Of late years there has been abundant evidence that shell-fish exposed to sewage pollution has caused Enteric Fever in persons who have consumed them.

In the course of this inquiry instances of Enteric Fever following the consumption of shell-fish from suspected sources were brought under my notice. Doctor Whittaker, Medical Superintendent Officer of Health, Belfast, stated that numerous cases of Enteric Fever had occurred in that city from time to time traceable to the eating of shell-fish collected from the sewage polluted shores of Belfast Lough, and I have received from Dr. Clibborn, Medical Inspector of the District, the following memorandum in support of this statement:—

“The sale of cockles gathered on the foreshore of Belfast Lough although not so extensively carried on as formerly, is still of considerable importance; but the quantity gathered by the general public (who come from nearly every part of the town) and carried home for consumption, probably exceeds to a large extent that gathered by those who earn their living by this occupation. As many as fifty to sixty persons have been counted gathering cockles in one day, close to the

sewage outfall works, and these people are not so particular as to the cleanness of the shell-fish, often picking up those which are highly discoloured and show up on the surface of the slob-land. Many cases of typhoid have occurred in houses where this class of shell-fish has been used.

“There are several persons who make a living by the taking of shell-fish from the foreshores of the Lough, and it will be interesting to give here the approximate quantities of the shell-fish taken during the years 1896 to 1902 inclusive, per returns made by the Coastguards to the Fisheries Department, Dublin.

SHELL-FISH TAKEN IN BELFAST LOUGH.

YEAR.	Periwinkles.	Cockles.	Crabs.	Lobsters.	Oysters.	Mussels.
	Tons. Cwts. Qrs.	Gallons.	Number.	Number.	Hundreds.	Tons. Cwts. Qrs.
1896, . .	26 6 0	16,600	7,800	3,816	510	150 0 0
1897, . .	29 9 0	19,000	7,200	2,040	400	130 0 0
1898, . .	0 10 0	10,000	6,500	2,550	240	100 0 0
1899, . .	9 10 0	1,728	5,000	1,890	240	90 0 0
1900, . .	34 11 0	14,000	4,000	2,250	180	—
1901, . .	56 14 0	2,510	3,000	2,100	120	1,397 0 0
1902, . .	59 5 0	1,500	2,000	21,694	—	1,029 0 0

“The greater part of the mussels, periwinkles, &c., are sent to England and Scotland, the mussels being used principally for bait, but the cockles are disposed of in Belfast. They are hawked in the evenings through the working class districts, sold to the residents, and in public-houses. Rag gatherers frequently carry them and exchange them to children for rags and bones.

“The following are a few instances of recent cases of typhoid which have occurred to persons, who, it is admitted, ate cockles a fortnight or three weeks prior to the onset of the disease. There are many instances where the patients suffering from Enteric Fever have denied eating shell-fish, although the Sanitary Inspector has found the empty cockle shells in the ashpit.

Mountcollyer-street.—In the house A, four cases occurred. About ten days prior to the first case, three of the children visited Greencastle, and ate a quantity of cockles; they brought some home and gave them to a fourth child. All four were attacked with typhoid.

Mileriver-street.—In the house B, three cases occurred. Mrs. B. says one of her boys went to Greencastle and brought home some cockles, of which the family partook, and about three weeks afterwards three of the family had typhoid.

Abercorn-street.—One case. The Sanitary Inspector was informed that the patient had eaten shell-fish.

Edward-street.—One case. The Sanitary Inspector was informed that the patient had eaten shell-fish.

Crimea-street.—Three cases in the house C, said to be caused by eating mussels gathered on the foreshore.

Harrisburg-street.—One case, alleged to be caused by eating cockles bought from a hawker on the street.

Hollywood-road.—Five cases.
Bloomfield-street.—Two cases.
Steen-street.—Three cases.
Manor-street.—Two cases.
Butler-street.—One case.
Spamount-street.—One case.
Valentine-street.—One case.
Little George's-street.—One case.
Matlock-street.—One case.
Maryville-avenue.—One case.
May-street (Little).—One case.
Clementine-street.—One case.
Keegan-street.—One case.
Burnaby-street.—One case.

Professor J. Lorrain Smith, M.D., has also referred to the matter in a valuable "Report on the occurrence of Typhoid Fever in Belfast," which he has recently made for the information of the Corporation. The following is an extract from the Report—

"Another means of spreading typhoid infection which is of interest to the citizens of Belfast, is the consumption of shell-fish taken from contaminated waters. Recently a good deal of attention has been given to this question. The problem as it affects Belfast I have dealt with in my report on the bacteria found in shell-fish taken from the Lough. In that report I gave evidence to prove that bacteria characteristic of sewage are to be found in the shell-fish obtained from these waters. The bacteria for which search was made were *bacillus coli communis*, *bacillus enteritidis sporogenes*, and *streptococci*. Shell-fish in which these microbes abound are to be regarded as a means of conveying typhoid infection."

Dr. Finegan, Medical Officer of Health, Carlingford, furnished me with a list of names of over thirty persons resident in his district who, during the past three years developed Enteric Fever after having eaten shell-fish. I made careful personal inquiries into about thirty of the cases with a view to discovering whether the disease could have been caused by any of the usual factors other than shell-fish, such as water, milk, other articles of diet, defective drainage, personal contact, &c. The water supplies used by the affected families or persons were obtained from different sources and were also used by other families who escaped infection, and besides there was no suspicion that any of these waters were subject to specific contamination. All, with one exception, seemed free from pollution from any source, the exception being a surface well to which cattle and fowl had access, but in this instance the water was used by another family without any ill effect. It appears, therefore, that water as a possible factor in causing the outbreak may be excluded. In the same way milk may be excluded, as the supplies were all from different sources to none of which could any suspicion be attached. As to defects in drainage or other insanitary conditions being a possible cause of outbreak the houses in which the cases of Enteric Fever occurred were, with few exceptions, isolated farm houses or fishermen's dwellings, the drainage and sanitary condition of which, generally speaking, could not be said to be defective. In fact I was struck by the general cleanliness and neatness of the houses, which were much above the average of other parts of the country. I think, therefore, that the outbreak was due to other than insanitary conditions.

Personal contact was responsible for a few of the cases, in all probability, as in some instances other members of the same family in which a previous case of Enteric Fever had occurred, contracted the disease within a short period subsequently; but, as far as I could learn, all of those who developed Enteric Fever had eaten shell-fish shortly before the onset of the disease. Owing to the length of time which had elapsed since the occurrence of the

cases, I found it very difficult to obtain accurate information. One case, that of a child of a coastguard, is particularly suggestive of the fact that the eating of uncooked cockles obtained from a source liable to pollution gave rise to an attack of Enteric Fever. The family, consisting of several members, partook of cockles obtained from Dundalk Bay. The child who developed Enteric Fever was the only member of the family who ate the cockles in their raw state, and some days subsequently commenced to feel unwell. In this case, as far as I could ascertain, there was no other possible source of infection.

At or shortly before the dates of the occurrence of the cases of Enteric Fever in the vicinity of Omeath, near Carlingford, some cases of the same disease occurred in the town of Newry, the sewage effluent from which enters the Newry River a few miles distant from the site of the public oyster fishery and private layings. It is therefore probable that the typhoid bacillus was present in the effluent, and infected the oysters partaken of by the persons who subsequently developed Enteric Fever in the Omeath district.

Two deaths from Enteric Fever occurred during the early part of the present year at Athlone. The disease was attributed, in both cases, to the eating of oysters said to have been obtained from an oyster laying at Clontarf, Dublin Bay. Doctor Edgar Flinn investigated these cases. His report, and also the statements of Doctor MacCormack, Medical Officer of Health, Athlone, are included in the report. There appears to be little doubt that the oyster layings at Clontarf are subject to pollution by sewage.

The presence of the typhoid bacillus or other pathogenic germs in the sewage effluent having access to oysters or other kinds of edible shell-fish must necessarily render the consumption of such shell-fish highly dangerous.

PACKING, &C., OF OYSTERS PRIOR TO TRANSIT.

The oysters imported from America for relaying are packed closely in barrels without water or other substance. Each barrel contains from 1,000 to 1,300 oysters. They are sent over during the months of March, April, and May in each year, the time occupied in transit averaging from ten to fourteen days. On arrival at the beds it is frequently found that some of the oysters, particularly those on the top of the barrels, have perished. The oysters are placed on the beds usually three or four in depth, where they remain for varying periods—from a few days to six months—according to the demand. They are intended for consumption during the summer months, when the sale of native oysters is prohibited, and as they can be disposed of at a cheap rate command a ready market at seaside resorts and populous centres. Approximately about 30,000,000 are laid down on Irish layings each season.

Oysters imported from France are, generally speaking, young brood intended for stocking private oyster beds, and are sent in wooden cases or baskets during the months of March, April, and May. Of late years the quantity imported has been small.

The American oysters are sent off from the layings packed in barrels or bags according to quantity.

The native oysters are usually packed with seaweed in boxes. More care seems, as a rule, to be taken in packing them than foreign oysters.

STORAGE OF OYSTERS IN SHOPS.

Consignments of oysters are, as a rule, obtained by retail dealers direct from the beds, from two to four times weekly as required, and are stored either in the shops or in special places on the premises set apart for their reception; with two or three exceptions no fault could be found with the conditions under which they are stored. In a few instances I found the

oysters were kept in tanks or tubs in fresh water, to which salt was added, the water being changed from time to time. In these instances the water was obtained from a pure source. As a rule, however, the oysters are simply laid on the floor or placed in the windows of shops, sometimes covered with seaweed and occasionally without any covering. They are kept at most for a few days only.

MUSSELS.

Over 2,000 tons of mussels are exported annually from Ireland. They are sent chiefly from Belfast Lough, Castlemaine Harbour, Dundalk Bay, River Boyne, Drogheda, and Wexford Harbour, to the Liverpool, Manchester, Glasgow, Bristol, Leeds, Bradford, Derby, Preston, and Wolverhampton markets. Those sent to Scotland are, I am informed, chiefly used for bait for fishing purposes, and those sent to England are used as food, after being cooked, but some might be eaten in the raw state. They are eaten to a very small extent in Ireland. Those taken from Belfast Lough, Dundalk Bay, Galway Harbour (near Dock), Sligo Harbour, Estuary of River Lee (Cork Harbour), River Boyne, Drogheda, and Wexford Harbour are, in my opinion, subject to contamination by sewage to a greater or less extent, and their use for edible purposes is therefore attended with considerable risk, unless properly cooked beforehand. I have no information as to how mussels are stored in shops pending sale, as none are sold, as far as I could ascertain, in Ireland.

COCKLES.

About 1,000,000 gallons of cockles are collected annually on the coast of Ireland, principally at the following places:—Dublin Bay, Dundalk Bay, Ballycastle, County Mayo; Waterford, Wexford, Kinsale, Belfast Lough, Strangford Lough, Dundrum Bay, and Ballysodare Bay.

The cockles are disposed of locally by the gatherers. A small quantity are exported to Glasgow from Strangford Lough. They are usually eaten cooked, but sometimes in the raw state. Those collected near Belfast and on the strands near Dundalk, Dublin, and Wexford, are, I consider, subject to pollution by sewage. Cases of Enteric Fever have, I am informed, occurred from time to time at Belfast, Dublin, and Carlingford, attributable to the eating of cockles collected near these places. The localities from which cockles are collected, and which I consider are subject to pollution, are as follows:—Cork Harbour (Estuary of River Lee); Bawnard Creek (Estuary of Ballinacurra River); strand opposite Kinsale town (Estuary of Bandon River); strand near Clonakilty; Belfast Lough; Dundalk Bay; Dublin Bay; and strand close to Wexford town.

PERIWINKLES.

Periwinkles are collected practically all around the coast of Ireland, and are chiefly exported to the London, Liverpool, and Manchester markets. About 1,500 tons are exported annually packed in bags. Periwinkles are not used as food in Ireland, except to a very small extent. Before being eaten they are plunged in boiling water for a short time, but whether long enough to destroy pathogenic germs, if present, I am unable to state. As far as I could learn they are not collected in the vicinity of sewer outfalls, or in situations liable to pollution, but in some instances, I was informed, they are placed, pending despatch to market, in estuaries on the foreshore not far removed from possible sources of contamination. In those instances, if the periwinkles are not properly cooked, their consumption would be attended by a certain amount of risk.

EXTENT OF SHELL-FISH INDUSTRY.

From the inquiries which I have made during my tour of inspection, the estimated extent of the industry may be summarised as follows:—

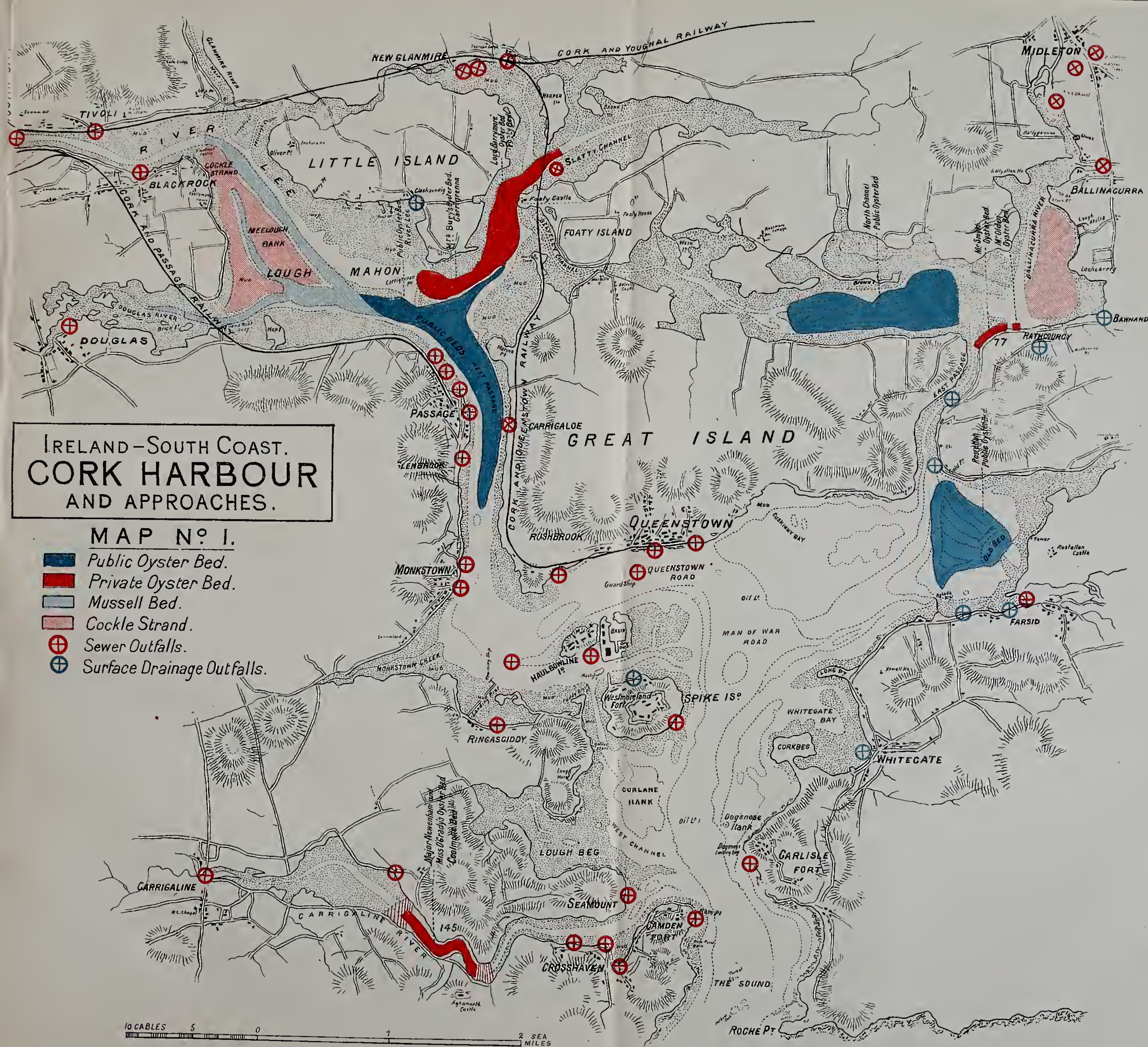
<i>Oysters.</i>					<i>Annual output.</i>
(a)	Public Fisheries,	.	.	.	6,000,000
(b)	Chartered Oyster Beds or Layings :—				
	(1) Native Oysters,	.	.	.	1,000,000
	(2) Foreign Oysters,	.	.	.	25,000,000
(c)	Licensed Oyster Beds or Layings :—				
	(1) Native Oysters,	.	.	.	2,000,000
	(2) Foreign Oysters,	.	.	.	5,050,000
(d)	Unlicensed Oyster Layings :—				
	(1) Native Oysters,	.	.	.	6,000,000
	(2) Foreign Oysters,	.	.	.	200,000
				Total, .	45,250,000
<i>Mussels.</i>					
Total	exported annually,	.	.	.	about 2,000 tons.
<i>Cockles.</i>					
Total	collected annually,	.	.	.	about 1,000,000 gallons.
<i>Periwinkles.</i>					
Total	exported annually,	.	.	.	about 1,500 tons.

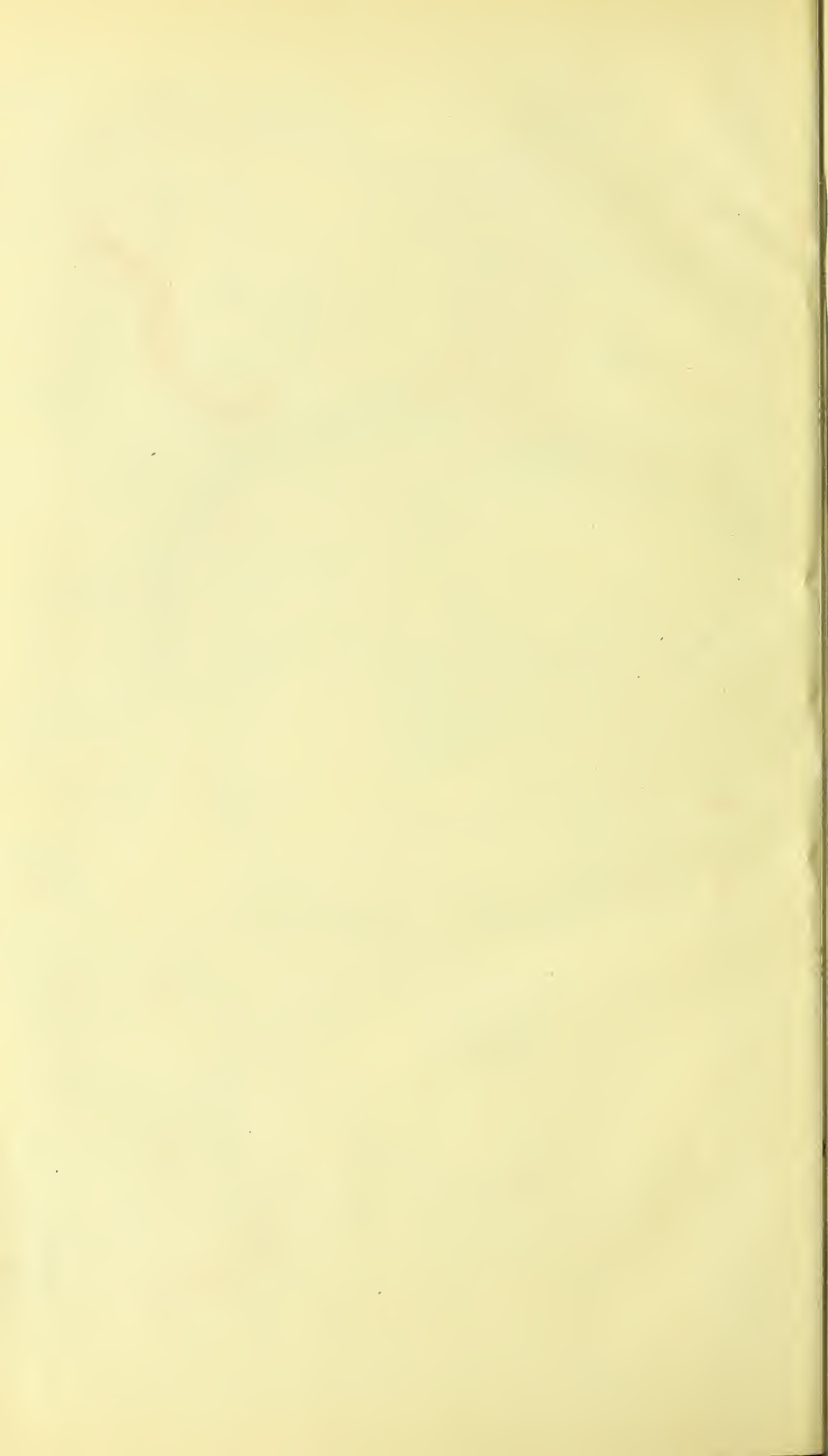
The accompanying detailed account of the conditions under which the shell-fish industry is carried on at the various places on the coast of Ireland goes to show that, in some instances, the oyster layings and public fisheries, and also the places from which other kinds of edible shell-fish are obtained, are subject to pollution by sewage. It would seem, therefore, that in such cases the only effectual remedy would be to put a stop to the taking of shell-fish from sources liable to pollution, as the difficulty and expense of diverting the sewage would, in most instances, be so great as to render such a proceeding impracticable, and I consider that for the protection of the public health against this danger legislation is required.

IRELAND—SOUTH COAST. CORK HARBOUR AND APPROACHES.

MAP N° 1.

- Public Oyster Bed.
- Private Oyster Bed.
- Mussell Bed.
- Cockle Strand.
- + Sewer Outfalls.
- ⊕ Surface Drainage Outfalls.





COAST OF COUNTY OF CORK.

CORK HARBOUR.

(ESTUARIES OF THE LEE, DOUGLAS, BALLINACURRA, AND CARRIGALINE RIVERS.)

There are three public, and five private, oyster beds in Cork Harbour and inlets.

PUBLIC OYSTER BEDS.

ROSTELLAN OYSTER BED. (Map No. 1.)

GENERAL DESCRIPTION.

This oyster bed is situate in the Midleton Rural District in the lower harbour, between Aghada Pier, Gold Point, and Rostellan Tower, in the estuary of Ballinacurra River. The position of the bed will be seen on reference to the accompanying map. It covers a large area, probably about 100 acres in extent, and approaches to within about 300 yards from the Pier at Aghada, and to a similar distance from Gold Point and Rostellan Tower. The average depth of water on the bed at low tide is about six feet. The ground formation is composed of a mixture of sand and mud, or sandy silt. In a portion of the bed the proportion of mud to sand largely varies, and where the mud is largely in excess the ground is soft and unsuitable for oysters. The bed is weedy and not in a cleanly state.

EXTENT OF INDUSTRY.

The bed is dredged from the middle of October till the end of January. During the close season for salmon fishing, the salmon fishermen turn their attention to dredging for oysters on the public beds, as it is not sufficiently remunerative at other times. When the weather conditions are suitable, six boats, each having a crew of three men, are engaged dredging, the number of oysters taken weekly would average about 800; these are purchased by Mr. Olden, Rathcoursey, and sent off direct by rail and steamer to merchants in Cork and Liverpool. They are sent packed with seaweed in boxes.

For the past fifteen years the yield of oysters from this bed has been very poor. Previous to that time, when portion of the bed was stocked with oysters by Mr. Wyse, and kept in a cleanly state, the yield was considerable, but of late years, owing to neglect, the unsuitability of the bed for spatting, or, rather, for retaining the spat, and, possibly, overdredging the yield of oysters, is so small as to scarcely repay the time and labour expended in dredging. The oysters taken from this bed are said to be fair-sized and in very good condition. The fall of spat observed has been inconsiderable for a number of years past.

Possible Sources of Contamination.

The villages of Aghada and Farsid are drained into the foreshore, the drainage consisting almost entirely of surface water and slops; a few houses of the better class, numbering about twelve, are drained on the water carriage system. The nearest sewerage outfall to the bed is distant about half a mile; the sewage of Aghada and Farsid villages flows in a channel some distance to the south of the bed. The tide sets very strong in the locality of the bed, and apparently all noxious matter is carried swiftly out of the harbour to the open sea, but it appears possible that on flood tides some of the sewage from Cork City, Queenstown, Midleton, and other places in Cork Harbour may find its way into the bed; this seems, however, to be

rather a remote possibility, and even if such were the case, owing to the distance of these places from the bed, and the great expanse of water in the harbour, the sewage must be in a very diluted state. The sewage discharged from the various places draining into Cork Harbour is not treated in any way as regards purification before being discharged.

NORTH CHANNEL PUBLIC OYSTER BED. (Map No. 1.)

GENERAL DESCRIPTION.

This oyster bed is situate in the North Channel, an inlet of the estuary of the Ballinacurra River, to the back of the Great Island, extending from near the northern entrance to the channel known as East Passage in a westerly direction for about one mile and a half. It is bounded on the north side by the Middleton Rural District, and on the south by the Great Island which is in the Cork Rural District. The bed covers a large area, probably close on 100 acres, and approaches to within 200 yards of the shore in places, but it is chiefly from the deepest part of the channel that oysters are dredged. The bed is not exposed at low water. The ground formation consists chiefly of sandy silt, mixed with debris of shells, and is covered with weeds and generally in a neglected state.

EXTENT OF INDUSTRY.

There has been a great falling off in the yield of oysters from this bed in recent years; during the past season only two boats were occasionally employed dredging during the months of November, December, and January, when there was no other occupation for the fishermen. Each boat obtained only from 100 to 150 oysters daily, at the most, but frequently a much smaller number, so that the work scarcely paid. The oysters were purchased by Mr. Olden, and those that were fit for market were despatched direct in boxes to the merchants, the rest being laid on his private bed at Rathcoursey. The oysters as a rule are small, but in good condition. The bed has the reputation of being a good fattening one, but owing to neglect has fallen into its present almost worthless state. A very fair fall of spat was observed during some seasons but not much latterly. The oysters taken from this bed are disposed of locally in Cork, and also sent to Liverpool merchants.

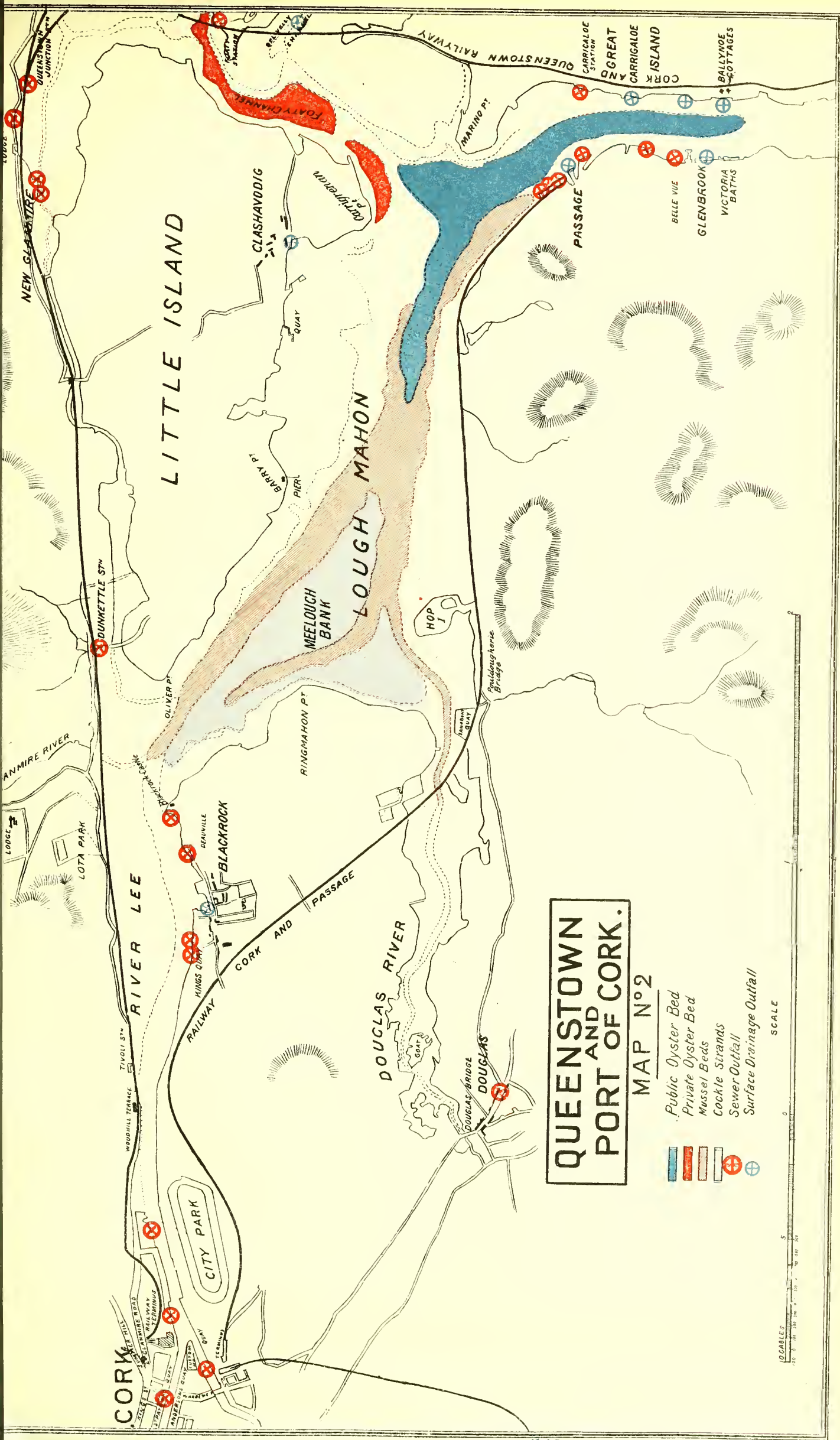
Possible Sources of Contamination.

There are no sources of contamination in the immediate vicinity of the bed. The only possible source of contamination apparently would be from the sewage of the town of Middleton being carried back on the flood tide after entering the East Passage. Middleton is about four miles to the east of the nearest point of the bed, and the sewage on its way to the sea flows in a channel about half a mile from the bed and through the East Passage. (See Map No. 1.) It would, therefore, appear that the possibility of contamination of this bed is remote.

PUBLIC OYSTER BED, RIVER LEE. (Map No. 2.)

GENERAL DESCRIPTION.

This oyster bed is situate in the estuary of the River Lee, Cork Rural District, and extends from a point opposite the Victoria Baths, Glenbrook, to within about half a mile of the point of the Meelough Bank and Lough Mahon—a distance of about two miles. It also extends towards the entrance to Foaty Channel for a short distance (see Map No. 2). The bed is in the channel of the river, and no portion of it is exposed at low



QUEENSTOWN AND PORT OF CORK.

MAP N°2

- Public Oyster Bed
- Private Oyster Bed
- Mussel Beds
- Cockle Strands
- Sewer Outfall
- Surface Drainage Outfall

SCALE



water. Its breadth varies from 100 yards to 50 yards. The bottom formation consists of a silty sand with shell debris, and is fairly clean and free from weeds, &c. Bordering on the channel where the oysters are found are soft mud banks on which oysters could not live; hence they are only to be found in the deep water.

EXTENT OF INDUSTRY.

There has been a very considerable falling off in the quantity of oysters taken from this bed during the past season, which is said to be due to over-dredging, particularly during the previous year, when a large number of young oysters were taken off the bed and disposed of to the owners of private beds for layings. During the past season dredging operations were carried on only during the close season for salmon fishing, viz., from middle of October till end of January, fourteen boats, each having a crew of three hands, being employed. The average take of oysters daily by each boat was a little over one hundred. In the previous year about 5,000 oysters were dredged daily. The oysters are sold direct to dealers in Cork City. Some are sent to Liverpool, Manchester, and London, and some are disposed of locally. Those exported are packed in boxes and forwarded by steamer direct to England. The oysters are not stored or kept longer than the day they are taken before being despatched to market. They are fair-sized, the shell averaging about three inches in diameter, the fish plump and in good condition. During the spatting season last year a fair amount of spat was observed.

Possible Sources of Contamination.

From the situation of this bed in the channel of the River Lee, which receives the crude sewage of the City of Cork, about three and a half miles above the nearest part of the bed, also the sewage of Blackrock, Douglas, Glanmire, Passage West, and Glenbrook, as well as the sewage of a large number of private houses drained directly into the river, there can be no doubt that the oyster bed is subject to pollution to a serious extent. On reference to Map No. 2, the principal sewer outfalls will be seen marked by a red cross. Those at Passage West and Glenbrook are within one hundred yards of the bed. The River Lee at Cork, and for some distance below the city, is highly charged with sewage matter at low water, and has much the appearance of an open sewer. The city has a population of over 86,000, and is drained on the water carriage system, as are also Blackrock, Passage West, and Glenbrook. No steps have been taken to prevent contamination of the beds by sewage. I have, however, been informed that no authenticated case of illness traceable to the consumption of oysters from this bed has ever been reported to the Medical Superintendent Office of Health, and from inquiries made from some of the leading medical gentlemen in Cork, I was unable to learn of any such case.

In addition to the possible sources of contamination already mentioned, the shipping passing up and down the river, the training ship, "*Black Prince*," the guardship stationed in the harbour, and other war ships, and also the sewage from Monkstown, Queenstown, Haulbowline, and Spike Islands, contribute towards the pollution of the River Lee.

PRIVATE AND LICENSED OYSTER BEDS.

FOATY OYSTER BED. (Map No. 2.)

GENERAL DESCRIPTION.

The Foaty oyster bed is owned by Lord Barrymore under charter, and is situate in Foaty and Slattery Channels, in the Cork Rural District. Foaty Channel or Creek opens off the River Lee, about one mile to the north, and on the opposite side of the river from Passage West. Slattery Channel is a

continuation of Foaty Channel. The oyster bed occupies the whole of the channel to within fifty yards of the shore on either side, and extends for about three-quarters of a mile eastward from a line drawn across the channel, opposite the Martello Tower, near its junction with the River Lee. (See Map No. 2.)

This bed has been in existence for a great number of years, but it is only within the past ten or twelve years that it has been worked to any considerable extent. It has acquired a reputation for growing and fattening oysters. The oysters are got from the public oyster bed on the River Lee, and from the public bed in Tralee Bay, and are laid down to grow and fatten, only a small proportion being raised from spat on the bed. The oysters which are laid on the bed remain for periods varying from ten months to three years, according to their marketable condition. The bed is thoroughly cleaned twice yearly before the fresh brood is laid, and before spatting commences. There is a strong current in the channels, which largely assists in keeping the beds clean. The bottom formation consists of a mixture of gravel, sand, and mud (about three-fourths part of which is sand), and also of debris of shells in large quantities. The close season extends from the middle of June to the middle of October. No portion of the bed is exposed at low water.

EXTENT OF INDUSTRY.

The bed is at present well stocked, having on it well over one million oysters. The average annual output is about 600,000 oysters, but for some months past the demand for oysters has fallen off greatly in consequence of the scare caused by cases of enteric fever having been reported as due to the eating of oysters in certain parts of England. Eight men are employed on the bed, and a small steam launch is used for dredging. The oysters are taken direct from the bed to a packing house close by, where they are sorted and packed in cases, with seaweed, and forwarded daily by rail and steamer to customers in London, Leeds, Bradford, Wakefield, Sunderland, Glasgow, Belfast, Dublin, Cork, and elsewhere.

I shall refer later on to the treatment which oysters receive from their despatch from the bed until they are consumed.

Mr. Mason is in charge of this oyster bed for the past two years, and has had many years' experience in oyster culture on beds on the English coast.

Possible Sources of Contamination.

The only source of contamination close to the bed is from a water-closet in connection with the railway station at Fota. This closet is, I believe, very little used. It discharges into an open drain which enters Slattery Channel about fifty yards from the nearest point of the bed. Other possible sources of contamination are the drainage from Queenstown Junction Railway Station, and from a private residence close to the station, which drain into the channel about one mile from the bed; Glounthane village, which is drained on the water-carriage system, with seventeen houses and two schools, the population being about 100, and the average attendance at the schools also about 100. There are twelve water-closets in the village, and its distance from the nearest point of the bed is about two miles. The River Lee, into which the sewage of Cork City, Blackrock, Passage West, and other places is discharged, flows past Foaty Channel, about one mile from the nearest point of the bed. This could only affect the bed by some portion of the sewage being carried back into Foaty Channel on flood tides. After a careful consideration of the facts, it appears to me that there is very little risk of pollution of this bed.

RATHCOURSEY OYSTER LAYINGS.

MR. J. J. SMYTH'S LICENSED OYSTER BED. (Map No. 1.)

GENERAL DESCRIPTION.

A licence was granted for this oyster bed in 1867. It is situate in the Midleton Rural District, in the estuary of the Ballinacurra River, on the eastern shore at the northern entrance to East Passage, in the townland of Rathcoursey. The area of the bed is $10\frac{1}{2}$ acres, but only about half of this area is available for oyster layings. The bed occupies a narrow strip about 500 yards long, extending from low water mark for about thirty yards towards the channel of the river. The ground formation of the bed is a sandy ooze, and is not at present in a very cleanly state. There is very little stock on the bed, and for the past two years it has not been worked. The bed was used for growing and fattening purposes. The fall of spat was insignificant. Mr. Smyth states that when the bed was being worked he was in the habit of stocking it with young oysters from Arcachon (France); the oysters remained on the bed from two to three years, and were disposed of to Mr. Olden (who has a bed adjoining Mr. Smyth's). The output of oysters from the bed used to average about 25,000 annually, and were sent off direct from the bed, packed in boxes, to merchants in Liverpool and Cork. The bed was poached, and this is, I understand, why it is not worked at present.

Possible Sources of Contamination.

The village of Rathcoursey, consisting of about fifty scattered dwellings occupied by fishermen, is about half a mile distant from the bed. There is no system of drainage provided for the village. The village of Ballinacurra, having a population of 480, is situate about three miles further up the river from the bed. The drainage of this village, which is composed chiefly of surface water and slops, discharges direct into the river close to the village. There are about six water-closets in the village, and very little excrementitious matter finds its way into the river at this point. The chief source of pollution to which this oyster bed is possibly subject is the sewage of the town of Midleton, having a population of 3,361. The sewage of Midleton is discharged into the river by two main outlets, one about the centre of the town, and the second a little below the town, about four miles distant from the oyster bed. Midleton is drained partially on the water carriage system, about one-fourth of the houses having water-closets. The sewage is discharged in its crude state into the river, which at a low state of the tide contains only a small volume of water. The sewage, in its diluted state, must flow past the oyster bed on its way out to sea, and would possibly give rise to pollution of the oyster bed.

MR. OLDEN'S OYSTER BED. (Map No. 1.)

This bed is a private one, but is not licensed. It adjoins Mr. Smyth's bed in the estuary of the Ballinacurra River, being situate to the east of it, and nearer to Rathcoursey village. The area of the bed is about $2\frac{1}{2}$ acres. It extends from low water mark along the shore for a distance of about twenty perches, and towards the channel of Ballinacurra River for about thirty yards. It is in the Midleton Rural District. The bed is used entirely for laying oysters for fattening and storing purposes. The oysters are dredged from the public beds in Cork Harbour, and laid down on this bed for periods varying from one to three years, or until the oysters are fit for market. Mr. Olden is the principal buyer of oysters dredged by the fishermen from the public beds in Cork Harbour. He states that his daily purchases during the months of November, December, and January averages about 1,000. These oysters are packed in boxes and forwarded daily direct to merchants in Liverpool and Cork. (The Liver-

pool customers are Messrs. Petrie, David Reid, Carroll and McDaniel; the Cork customers Messrs. Morton, Riordan, Quin, O'Connor, and Market Lane Oyster Tavern.) Any of these oysters not required for immediate sale are laid down on the bed and taken up as required. Mr. Olden states that he disposes of about 800 oysters daily during the season, from middle of October to the middle of June. He had three boats employed dredging on the public oyster beds, each boat having a crew of three men. He gave up dredging operations on the 1st December last, as he found it did not pay him. He has also four hands employed picking and sorting oysters during the season.

Possible Sources of Contamination.

The same remarks as regards sewage pollution would apply to this bed as to the adjoining one owned by Mr. Smyth.

CARRIGRENNA OYSTER BED. (Maps Nos. 1 and 2.)

LICENSED BED No. 75.

This oyster bed is situate in Lough Mahon, estuary of the River Lee, at the entrance to Foaty Channel, opposite Carrigrenna Point, Cork Rural District. It is owned by Mrs. Bury, and covers an area of 70 acres, twenty of which are available for oyster culture. The bed is practically derelict, and has not been worked for about five years; very few oysters are to be found on it. It extends from low water mark for about fifty yards towards the channel of the River Lee. The bottom formation is a sandy silt, and is not clean, having been neglected for some years. I understand that the local fishermen occasionally dredge the bed, and any oysters obtained are disposed of to local dealers in Cork.

As regards the possible sources of contamination by sewage, the same remarks apply as to the public oyster bed on the River Lee, which adjoins this bed, but, in my opinion, the liability to contamination is much less owing to the distance of the bed from channel of river.

COOLMORE AND AGHAMARTA OYSTER BED.

LICENSED BED No. 145. (Map No. 1.)

This oyster bed is owned jointly by Major Newenham, Coolmore, and Miss O'Grady, Aghamarta. It is situate in the Carrigaline River, between the Cork Rural District and Kinsale Rural District. The bed occupies the channel of the river from a point within one mile of Crosshaven village to a point within a mile and a half of Carrigaline village, and covers about one mile of the river, but only a small portion of the bed near its centre, about eight acres in extent, is availed of for oyster culture. The total area of this licensed bed is 77 acres, but only a small portion is worked owing to the unsuitable nature of the bottom, the portion nearest Crosshaven being rocky, and that nearest Carrigaline very silty and weedy. The ground towards the centre of bed is the most suitable for oysters, and is composed of a mixture of pebbles, sand, and bluish marl, with debris of shells. The banks of the river are muddy, with shingle in places. The bed is about thirty yards in width in the centre of the channel of the river, and is not exposed at low water. The fall of spat is very inconsiderable. The bed is used chiefly for laying down oysters and growing them. A few years ago 11,000 Brittany oysters were laid down, and at the beginning of last season 5,000 oysters from Tralee Bay. The oysters usually remain on the bed for periods varying from one to three years. The bed is not considered very suitable for fattening purposes. From 3,000 to 4,000 oysters are dredged from the bed annually and used for private consumption or given to friends. The oysters are taken from the bed as they are required. Only one man is employed occasionally on the bed, which is not very clean.

Possible Sources of Contamination.

The sewer outlet from Coolmore House is within about 200 yards of the nearest point of the bed, but I understand it is merely the overflow from a cesspit which discharges into the sewer. The drainage of Carrigaline village passes into the river about two miles above the bed, and the drainage of Crosshaven about one and a half miles below the nearest point of the bed. Currabinny sewer discharges about half a mile further down from Crosshaven. The two last mentioned places are drained on the water carriage system. The combined population numbers about 1,000 during the summer months. Both places are favourite seaside resorts. The number of water-closets would amount to about 130. The drainage from Carrigaline village consists chiefly of surface water and slops, as there are very few water-closets. Pollution of the bed would appear to arise chiefly from the sewage of Crosshaven and Currabinny being carried up the Carrigaline river on flood tides; this I consider probable.

MUSSELS, CORK HARBOUR. (Map No. 1.)

Mussels are dredged from the channel of the River Lee, between Blackrock Castle and Passage, and in Douglas Channel, estuary of the Douglas River, to a little above the railway bridge. They are also picked on the shores and in creeks at low water of spring tides. Three boats, each having a crew of three men, are engaged at dredging operations from the middle of October to the middle of May. About fifty bags of mussels are exported weekly during this period to Messrs. Mussen, Liverpool. They are shipped direct from Cork three times each week. I have been unable to ascertain whether the mussels are eaten or used as bait for fishing, but they are probably applied to both uses. As regards possible contamination, the same observations apply to the mussels as to the oysters from the public oyster bed in River Lee and Lough Mahon, but as the mussels are taken from the river two miles nearer to Cork, I consider the mussels must be contaminated to a much greater extent.

The mussels are purchased from the fishermen by Mr. O'Leary, Blackrock, who ships them off direct to Liverpool. None appear to be disposed of locally or used for food at Cork.

COCKLES, CORK HARBOUR. (Maps Nos. 1 and 2.)

A few women are employed collecting cockles from March to September on Meelough Strand, and from Blackrock Castle on the strand to a point opposite Hop Island, in Douglas Channel, as well as at Bawnard Creek, on the Ballinacurra River; a few bushels of periwinkles are also gathered from Bawnard Strand each week and shipped to London. The cockles are disposed of in Cork; and are, as a rule, eaten cooked.

I consider the cockles gathered on Meelough Strand and vicinity are subject to pollution by sewage to a serious extent, and those from Bawnard Strand much less so. A very small trade is done in cockles from Cork Harbour, the supply coming chiefly from Courtmacsherry, Clonakilty, and Ringabella Bays.

DESCRIPTION OF THE TREATMENT TO WHICH SHELL-FISH ARE SUBJECTED FROM THE TIME THEY ARE DESPATCHED FROM THE BEDS UNTIL THEY ARE CONSUMED.

In order to ascertain information on this point I visited the shops and stores of dealers in Cork, and found that they usually obtain their supplies of shell-fish as required, and do not store them for a longer period than a day or two. The shell-fish are kept in the windows of the shops or under the counters, and in none of the places which I visited did I find anything which would give rise to any suspicion of contamination from the time of receipt of the shell-fish until they are disposed of.

RIVER BANDON, KINSALE HARBOUR. (Map No. 3.)

PUBLIC OYSTER BED.

This oyster bed is situate in the estuary of the Bandon River, Kinsale Harbour, and Kinsale Rural District. The bed is in the channel of the river, and extends for about one mile and a half from March Causeway to the Western Bridge which crosses the river about three and a half miles to the west of Kinsale town. The nearest point of the bed is distant from Kinsale about two miles, Kinsale being between the bed and the mouth of the harbour. There is a large expanse of water where the bed is, and the channel is very deep in places. No portion of the bed is exposed at low water. The bottom formation consists of sandy silt and in places is weedy. In former years there was a fair yield of oysters from this bed, but latterly very few oysters are to be had. One or two boats occasionally dredge during the months of January, February, and March. The take of oysters by each boat daily is very small, rarely exceeding a dozen. During the three months in which dredging operations are carried on the total take would amount to 1,000 oysters. The oysters are sold locally. It is stated that the scarcity of oysters is due to overdredging in former years. The fall of spat is very insignificant. The oysters are reported to be fair-sized and in good condition.

As regards the possibility of pollution, the nearest sewer outfalls are at Kinsale, two miles seaward of the bed. A strong current sets in the harbour, which carries the sewage out to sea. It is possible that on flood tides a portion of the sewage in a diluted form may be carried back on the bed. I am of opinion, however, that the chances of pollution are remote, as only a small proportion of the houses in Kinsale are drained on the water carriage system. The population of the town is 4,600.

MUSSELS.

Mussels are gathered from the rocks and along the foreshore to the north of the oyster bed. They are only used as bait for fishing, and I am informed that they are not eaten.

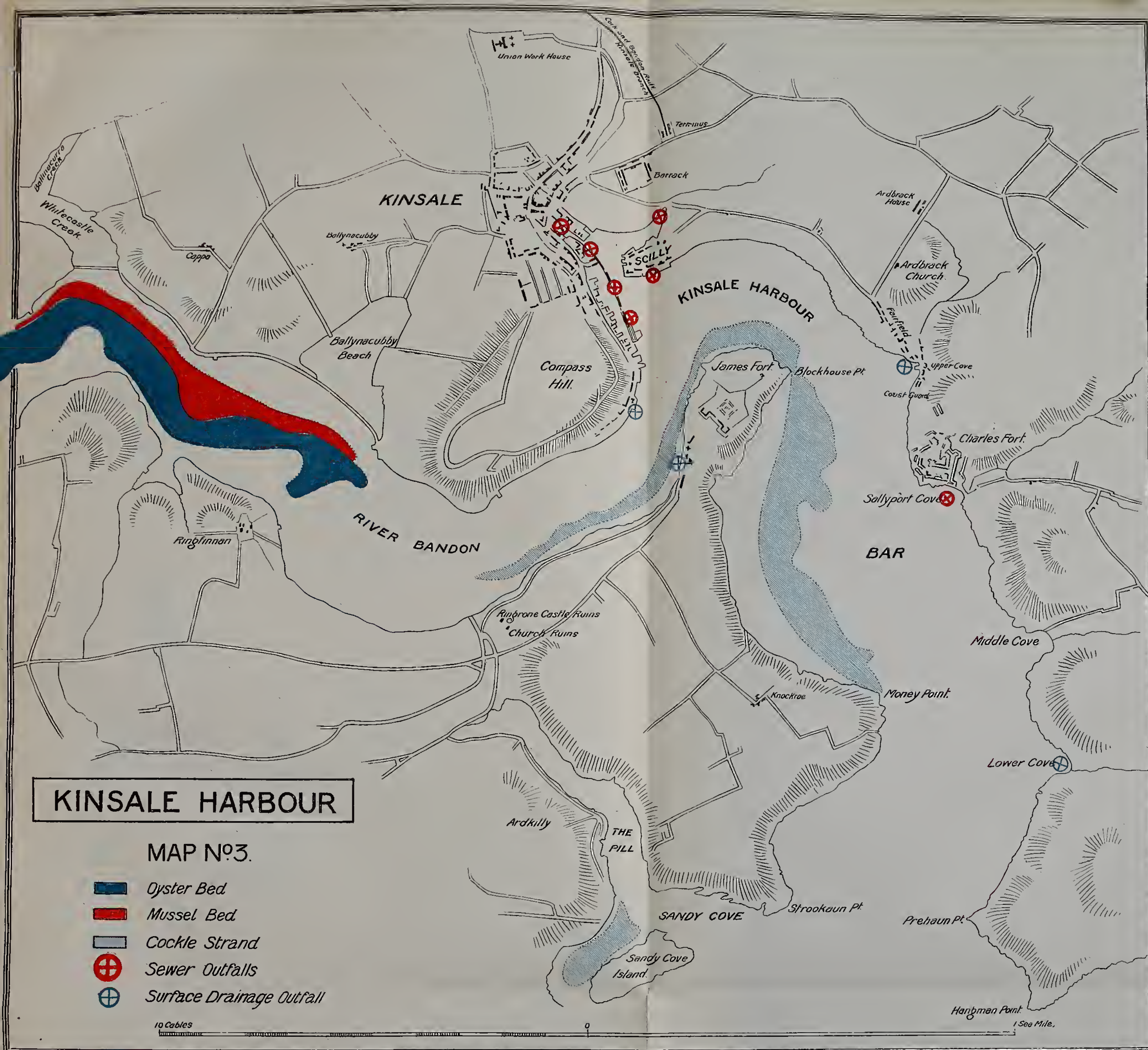
COCKLES AND PERIWINKLES.

Cockles and Periwinkles are gathered on the strand from a point opposite Ringrone Castle on the Bandon River to Money Point, near the entrance to the harbour. Only one woman collects cockles, and disposes of them locally. A few cockles are also collected off the strand inside Sandy Cove Island. There is no risk of contamination of cockles at the latter place, but it is possible that cockles at the first-named locality may be polluted, although the sewage from Kinsale is carried in the channel to the north side of the harbour some distance from the cockle strand.

Periwinkles are also collected inside Kinsale Harbour, and for some distance around the coast. About twenty persons are engaged collecting them from the 1st November till the end of March. They are purchased by a local dealer, who stores them in barrels in an outhouse, adding fresh salt water daily, and when a sufficient quantity has accumulated ships them to Messrs. Wright, Billingsgate, London. They are despatched about once each fortnight in bags. Only about twenty bags were sent off during the past season.






BALLYCOTTON—YOUGHAL AND DUNGARVAN DISTRICT.

Periwinkles are the only kind of shell-fish collected in these districts. During the months of January, February, and March of each year some hundreds of persons collect periwinkles around this part of the coast. About



KINSALE HARBOUR

MAP N°3.

-  Oyster Bed
-  Mussel Bed
-  Cockle Strand
-  Sewer Outfalls
-  Surface Drainage Outfall

10 Cables

1 Sea Mile.



**COURTMACSHERRY
BAY**

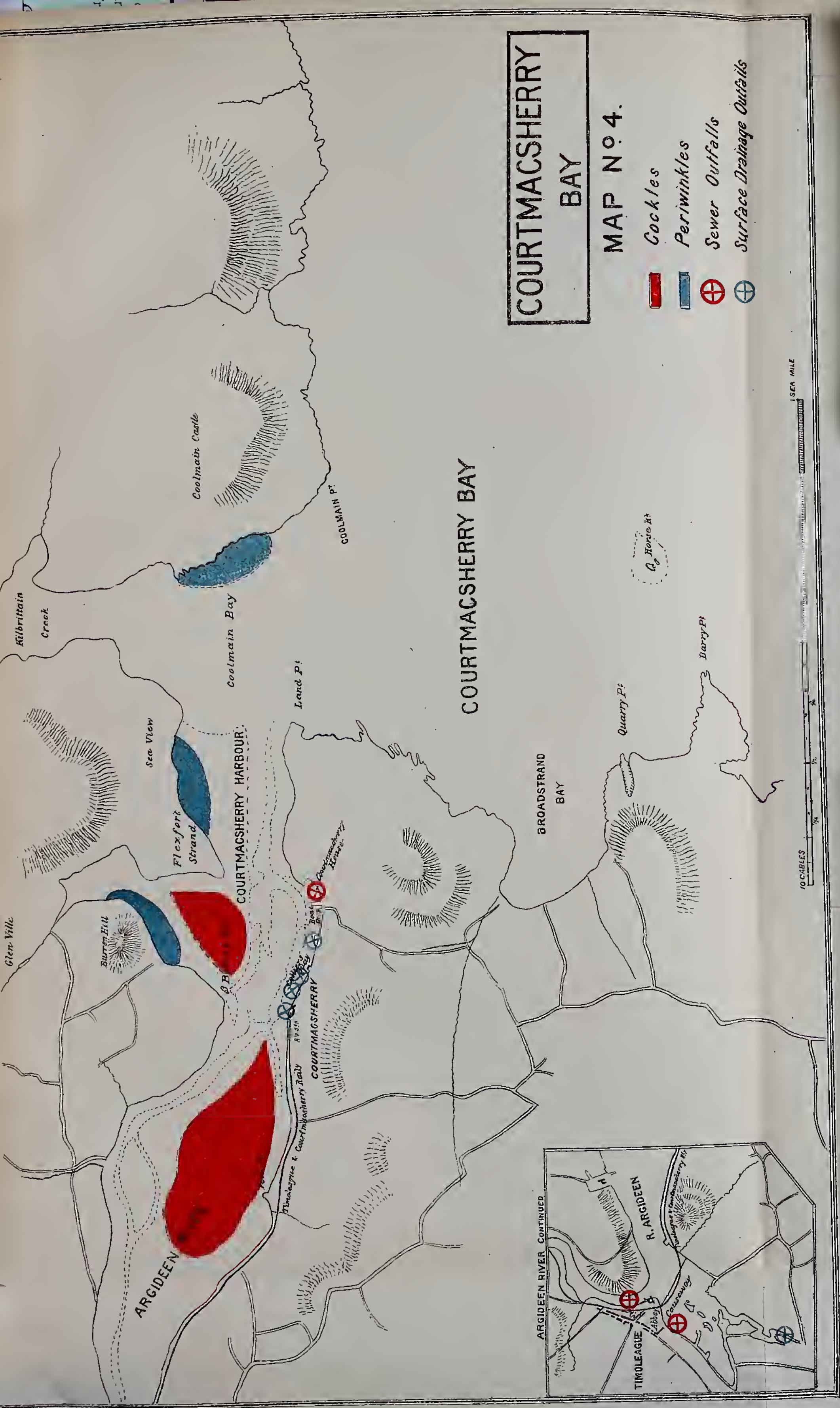
MAP No. 4.

Cockles

Periwinkles

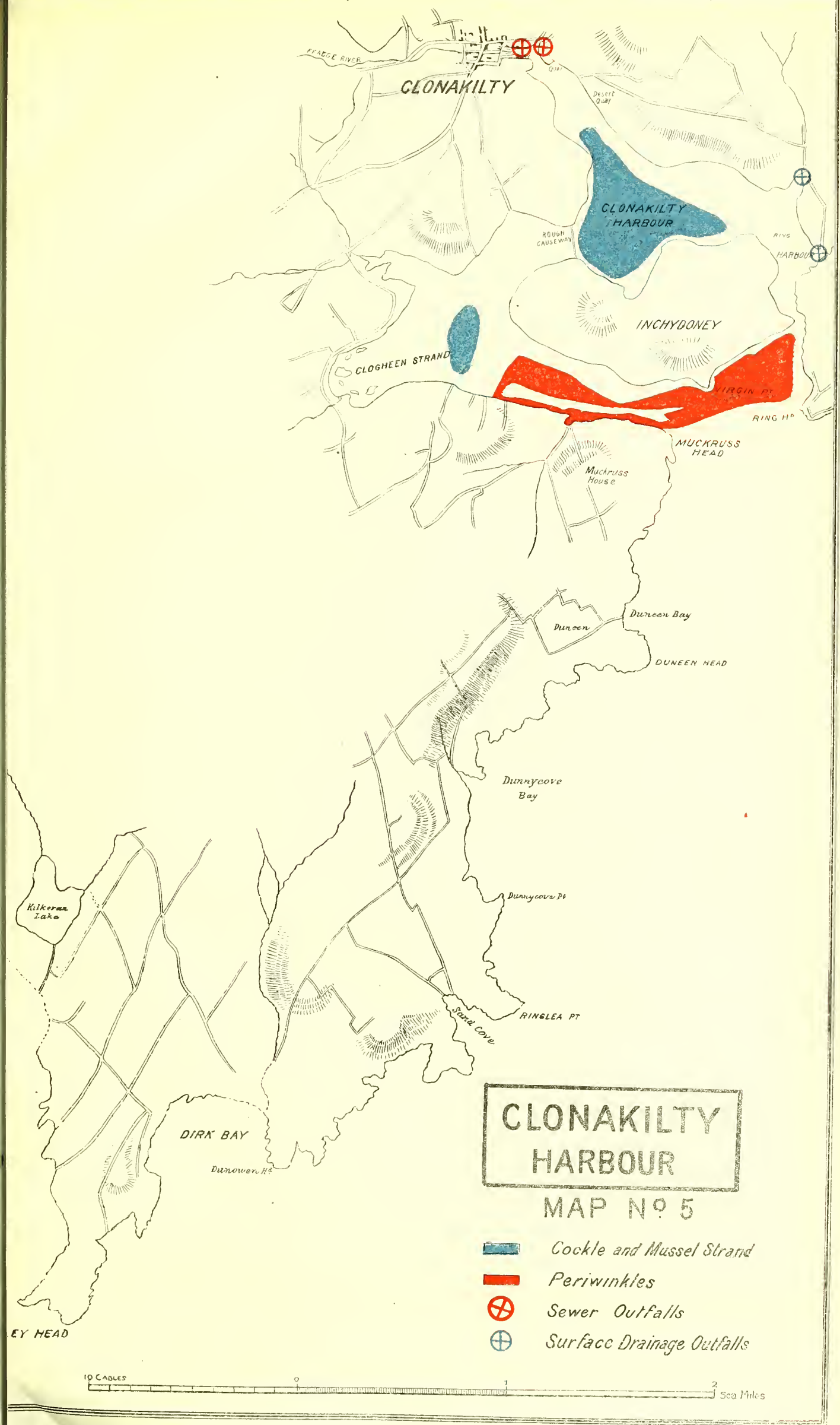
Sewer Outfalls

Surface Drainage Outfalls



10 CABLES



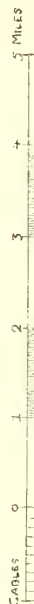
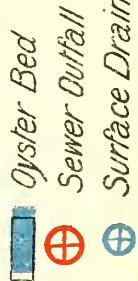




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CLANDORE HARBOUR




MAP No. 6

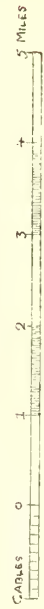




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MAP No. 6

-  *Oyster Bed*
 *Sewer Outfall*
 *Surface Drainage Outfalls*





80 tons of periwinkles are exported annually to the Billingsgate Market, London. They are bought by local dealers and are usually stowed in barrels with salt water or in bags on the shore between high and low water mark until a sufficient quantity to ship off has accumulated.

A few lobsters and crabs are caught on this coast, but not in sufficient numbers to pay the cost of sending them to distant markets. They are disposed of locally.

Periwinkles are gathered from localities as a rule far removed from any risk of sewage contamination. They are always eaten cooked, which would possibly have the effect of destroying pathogenic organisms, if present.

COURTMACSHERRY HARBOUR. (Map No. 4.)

Cockles and periwinkles are gathered in this harbour. The former are collected on the strand opposite Courtmacsherry village, and on the strand at the mouth of Argideen River to the north of Courtmacsherry. Only a very limited trade is done in cockles. Small consignments are sent occasionally to Cork. The nearest points of the cockle strands to Courtmacsherry are about 500 yards from it. The channel into which any sewage matter from the village passes is situate between the village and the cockle strands. There is a large expanse of water in the harbour, and not much possibility of contamination, as very little sewage matter is discharged into the harbour. There are only three or four water-closets in the village, the drainage of which consists chiefly of surface water and slops.

Periwinkles are picked at three or four places in Courtmacsherry Harbour and along the shore outside. About forty people are engaged at the work when tides are suitable. The periwinkles are bought from the pickers by a local merchant and sent off weekly in bags to Billingsgate Market. About fifteen cwt. weight is sent off weekly during season.

CLONAKILTY HARBOUR. (Map No. 5.)

Cockles, periwinkles, and mussels are collected in this harbour.

The localities from which cockles and mussels are picked will be seen on reference to Map No. 5, viz., on the strand inside Inchydoney Island, and on the south strand to the west of this island. On the strand inside Inchydoney, cockles and mussels are picked within a distance of half a mile from the sewer outfalls of the town of Clonakilty, the population of which is 3,221. There are a considerable number of water-closets in the town, and it is highly probable that some of the sewage matter may find its way into the strand and pollute the shell-fish.

About twenty persons are engaged picking cockles and mussels, which are purchased by a local dealer. The cockles, about two bags weekly, are sent to Cork, and the mussels to Liverpool.

Periwinkles are chiefly picked on the strand outside Inchydoney Island, and on the shore outside the harbour; about a dozen persons are engaged in picking them during the winter months. They are bought by a local dealer and sent to Billingsgate Market weekly. Only a very small trade is done.

GLANDORE HARBOUR. (Map No. 6.)

A few hundreds of oysters are picked up at low water of spring tides on the shore from Myross Wood to Glandore during the season. The oysters are small, and are sold locally and at Skibbereen. About fifty years ago some oysters were laid by the late Lord Kingston, but the laying proved a failure, owing probably to the muddy nature of the ground. The bed is not licensed, and very few oysters are to be had from it. The only possible contamination is that which might arise from the drainage from the villages of Leap, Union Hall, and Glandore. These are, however, small villages, and are practically undrained, only surface water and slops finding their way into the harbour.

Periwinkles are collected along the shore inside and outside the harbour, and are bought from the pickers by a local trader who forwards them regularly to the London Market. The trade is, however, a very small one.

Glandore Harbour is situate in Skibbereen Rural District.

BARLOGUE HARBOUR. (Map No. 7.)

In Barlogue Harbour, at the entrance to Lough Hyne, and inside Bullock Island, an oyster bed was formerly located. The bed was stocked by the late Sir H. Beecher about twelve years ago, but did not prove a success, owing probably to the muddy nature of the ground and the difficulty of keeping it free from weeds, &c. I am informed that no oysters are to be found on this bed at present. It has been given up for several years. There is no suspicion of contamination. The bed is in the Skibbereen Rural District, and is not licensed.

BALTIMORE HARBOUR, RIVER ILEN, SKIBBEREEN RURAL DISTRICT. (Map No. 7.)

A public oyster bed on the River Ilen between Yellow Point on the South and Aghadown Church on the north, produces a few hundred oysters yearly. The bed is situate in the channel of the river and is occasionally dredged by one boat during the season, a day's dredging resulting in the capture of two or three dozen oysters at the most. The oysters are sold in Skibbereen, and are said to be of excellent quality both as regards size, flavour, &c. The bottom is firm and clean, and composed of a mixture of sand and mud.

About forty years ago the late Mr. Townsend, of Runnadinna, owned and stocked this bed.

I am informed that a fair fall of spat is observed every season, but probably it is not retained in bed.

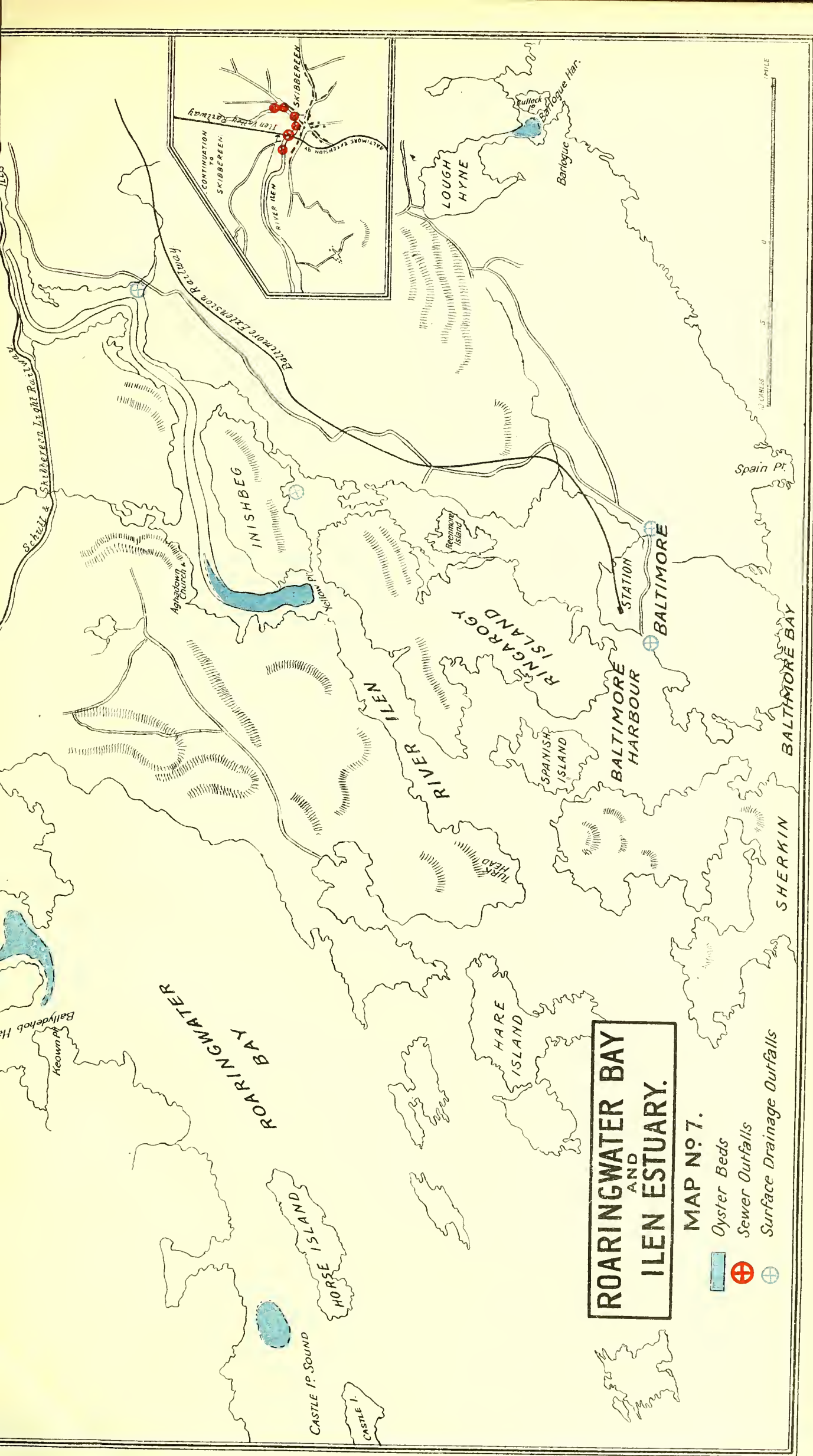
The nearest source of contamination is the sewer effluent at Skibbereen, which is five miles distant. This town has a population of 3,269, and is drained direct into the River Ilen as it passes through the town, there being several sewer outlets. There are a considerable number of water-closets, but having regard to the distance and the large volume of water in the river, the chances of pollution of this bed seem remote.

ROARINGWATER BAY, SKULL RURAL DISTRICT. (Map No. 7.)




There is a public oyster bed in Skeaghmore Harbour, extending as far as Keown Point, at the entrance to Ballydehob Harbour. This bed was owned privately, and stocked about thirty years ago, but has been derelict for many years past. At low water of spring tides a few oysters are picked up, amounting probably to a few hundreds annually during the season. The oysters are sold locally in Ballydehob and Skibbereen. The bottom formation consists of sand with an admixture of mud; it is firm, but weedy and neglected. The bed would probably cover an area of close on 100 acres. Any oysters in the bed are raised from spat, and are said to be fair sized and of good quality, as regards plumpness and flavour. The bed appears to be free from suspicion of contamination by sewage. The nearest sewer outfall is at Ballydehob village, which is situate at the top of Ballydehob Harbour, about two miles from the bed, and, being in another harbour, the sewage matter would scarcely be likely to find its way into the bed.

HICKS OYSTER BED, ROARINGWATER BAY, SKULL RURAL DISTRICT. (Map No. 7.)

This oyster bed is the property of the Rev. T. V. Hicks, and was licensed in 1867. It is situate between Castle Island and the mainland, at the upper part of Castle Island Sound. It covers an area of about 100 acres. About twenty-five years ago oysters were laid on the bed. It has not been worked for over twenty years, and I was informed that no oysters are to be found there now. There is no suspicion of contamination, it being so far removed from any source of pollution.

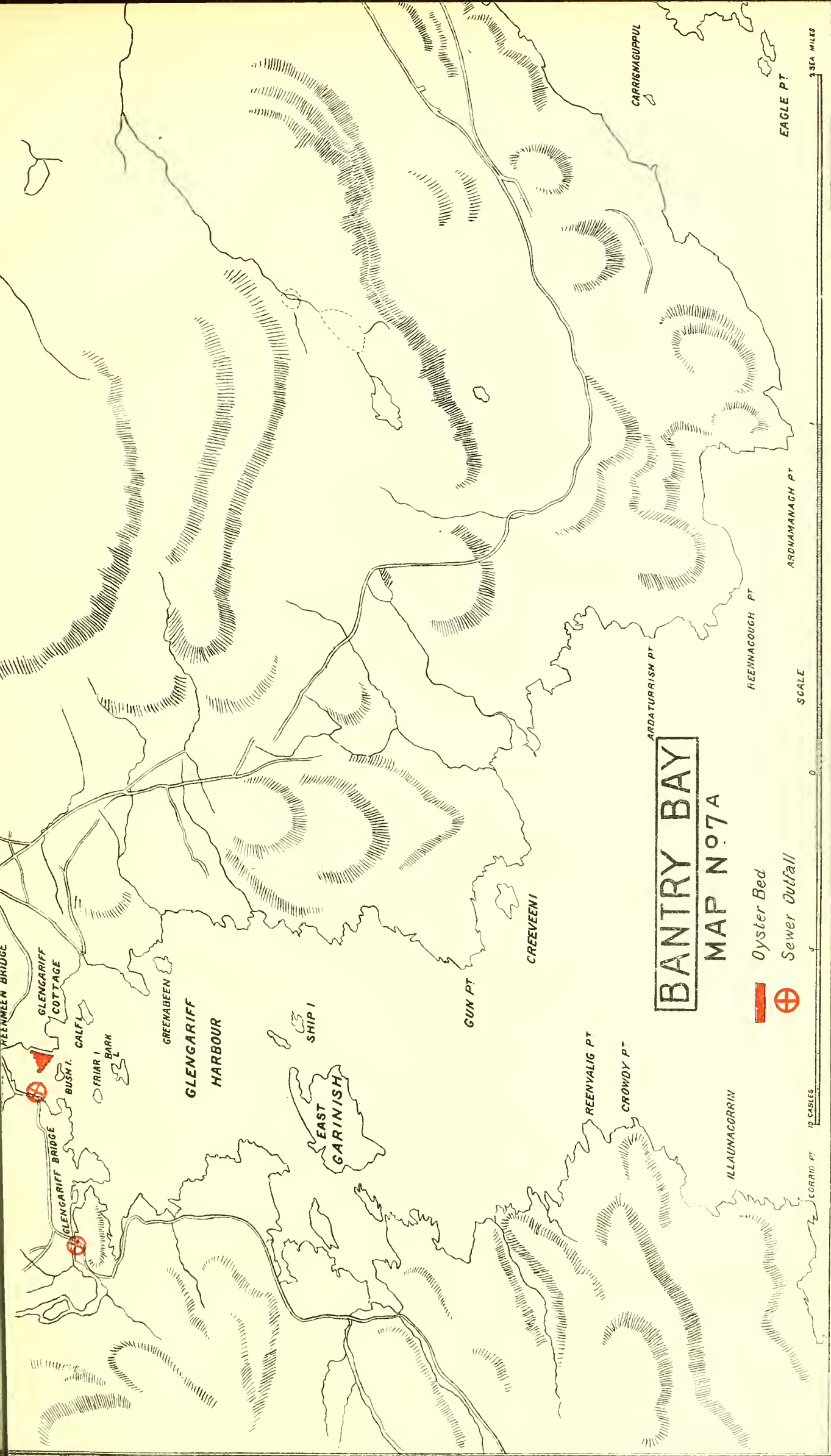


MAP No. 7.
ROARINGWATER BAY
AND
ILEN ESTUARY.

-  Oyster Beds
-  Sewer Outfalls
-  Surface Drainage Outfalls

0 5 10
MILES
0 10 20
FURLONGS





BANTRY BAY

MAP No 7A

- Oyster Bed
- Sewer Outfall

SCALE

2 SEA MILES

10 CABLES



BANTRY BAY, BANTRY RURAL DISTRICT. (Map No. 7A.)

GLENGARIFF LICENSED OYSTER BED.

This bed is situate inside Bush Island, Glengariff Harbour, between Bag Island and Reenmeen Point. It covers an area of 9 acres 1 rood, and is close to the shore, being uncovered at low water of spring tides. It is situate close to the mouth of Reenmeen River which, during floods, affects the bed very injuriously by deposits of sand, mud, &c., which kill the oysters. The bottom of the bed consists of sand with admixture of mud, and is fairly firm and clean. The oysters grow and fatten well on this bed. It is used entirely for layings. About two years ago 10,000 oysters from Tralee Bay were laid down on the bed, the greater number of which were destroyed by floods from the river close by. The bed is owned by the Eccles Hotel Company, Limited, Glengariff, and the oysters were only used in the hotel. About 3,000 oysters were taken up during the season from 1st September till end of April.

The sewage from the Eccles Hotel is discharged at the opposite side of the harbour, about 500 yards from the bed. The sewage matter is carried out to sea, but in flood tides I think it probable that portion of it might be carried back and contaminate the bed. There are very few, if any, oysters on the bed at present, and I am informed it is not intended to lay any more oysters there. The licence is about to be given up.

Other localities in BANTRY BAY and inlets where Oysters were formerly cultivated.

About twenty years ago the late Lord Bantry cultivated oysters at Poulgorram and Firkail inlets. The beds were extensive, and are said to have produced large quantities of oysters. The late Lord Bantry also owned two oyster beds which were situate on the Bantry side of Whiddy Island. The output of oysters from these beds is said to have been very large. There are no oysters on any of these beds at present, nor have they been for many years past.

The late Mr. Morris owned an oyster bed in Dunmanus Bay. It has not been worked for thirty years. No oysters are to be found on it now.

SCOLLOPS.

Eight boats are engaged dredging for scollops in Bantry Bay from 1st November till the end of March. About 2,000 scollops are taken weekly during this period by the boats, and are bought by local dealers, who send them to merchants in Cork and elsewhere.

PERIWINKLES.

Periwinkles are picked all around the shores of Bantry Bay and sent off weekly in bags to Billingsgate Market. About thirty tons are sent off during the season. The periwinkles are kept in bags on the shore between high and low water mark, about half a mile distant from Bantry town, until a sufficient quantity is collected to send off. The situation where the periwinkles are stored is too near the town and is subject to pollution by sewage. The periwinkles are, however, only eaten after cooking, which, if effectually done, should render them safe.

LOBSTERS AND CRABS.

Lobsters and crabs are plentiful in Bantry Bay and on the coast. About twelve boats are engaged in Bantry Bay fishing for lobsters from 1st April to 1st September. On the south coast there are probably over 100 boats employed. The lobsters are shipped direct to England in two large boats fitted with wells for keeping fish alive.



BANTRY BAY, BANTRY RURAL DISTRICT. (Map No. 7A.)

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COAST OF COUNTY OF KERRY.

ESTUARY OF KENMARE RIVER.

(Map No. 8.)

There are at present in force six licences to plant oyster beds on the Kenmare River and Estuary. There are two unlicensed beds and a public oyster fishery.

All are situate in Kenmare Rural District.

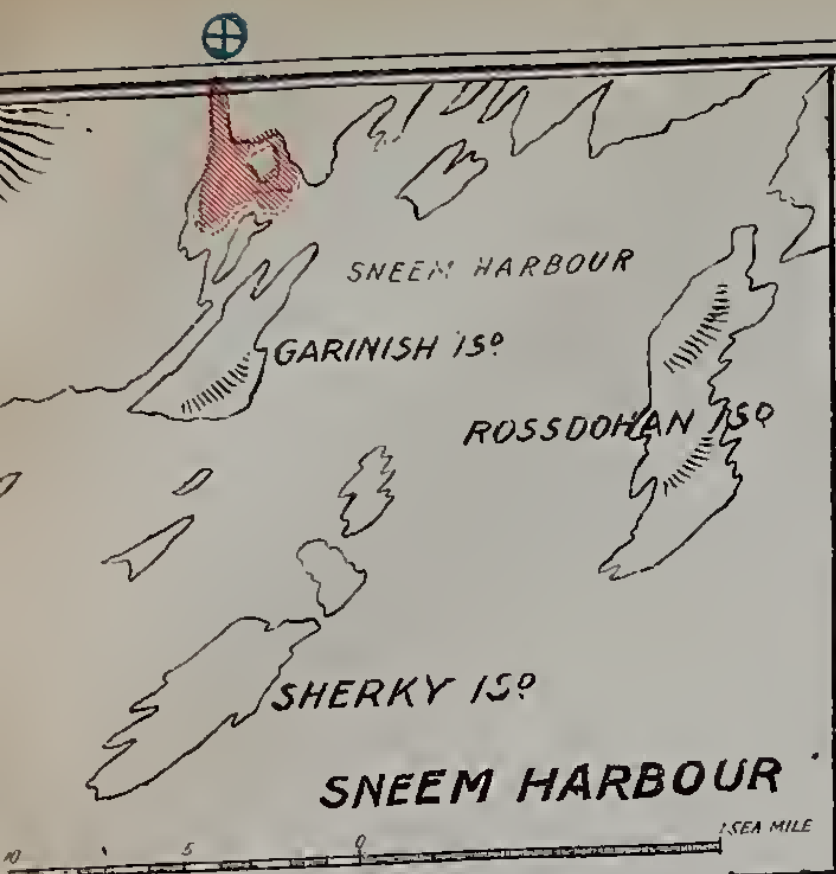
DERRYQUINNA OYSTER BEDS.

Sir J. Colomb, Derryquinna, is the owner of Nos. 60, 91, and 92, licensed beds, which are worked in conjunction. The beds cover an area of 271 acres, only 9 acres of which are stocked with oysters. The beds extend from Templenoe Pier in the west to close to Doon Point in the east, occupying practically the whole of Dunkerrin Harbour inside Dunkerrin Islands. About 50 acres of this area are suitable for oyster culture; the remaining portion, owing to the bottom formation consisting of soft mud, is unsuitable. The bottom formation of the suitable portion is composed chiefly of sand with an admixture of mud, and is fairly firm and kept clean and free from weeds. Portions of the beds are exposed at low water of spring tides. The oysters are chiefly raised from spat. Attempts have been made to collect spat, but these did not prove very successful. 12,000 oysters from Tralee Bay have recently been laid on the beds for growing and fattening, for which purposes the beds are said to be well adapted. The oysters remain on the beds from two to five years before being taken up. The oysters are used for private consumption only, none being sold. About 1,000 oysters are picked and dredged annually during the season from 1st September to 30th April. Only one person is employed.

As regards the possible sources of contamination, Derryquinna House is drained into a cesspit, the overflow from which discharges on the fore-shore about 200 yards distant from the nearest point of the beds. The drainage is, however, very inconsiderable. The town of Kenmare having a population of 1,189, is drained into Kenmare River close to the town, and about three miles distant from the beds. There are very few water-closets in the town; the drainage, consisting chiefly of storm water and slops, is conveyed in a channel on the southern side of the river opposite to where the oyster beds are, and about half a mile distant from the beds. The privies connected with Rossacussane National School discharge directly into a small stream which enters the sea about five hundred yards distant from the oyster beds and to seaward of them. The daily attendance of pupils at the school is about sixty. Pollution might possibly arise from this source, and also from the overflow of a cesspit into which Derryquinna House is drained.

GREENANE LAYINGS. (Map No. 8.)

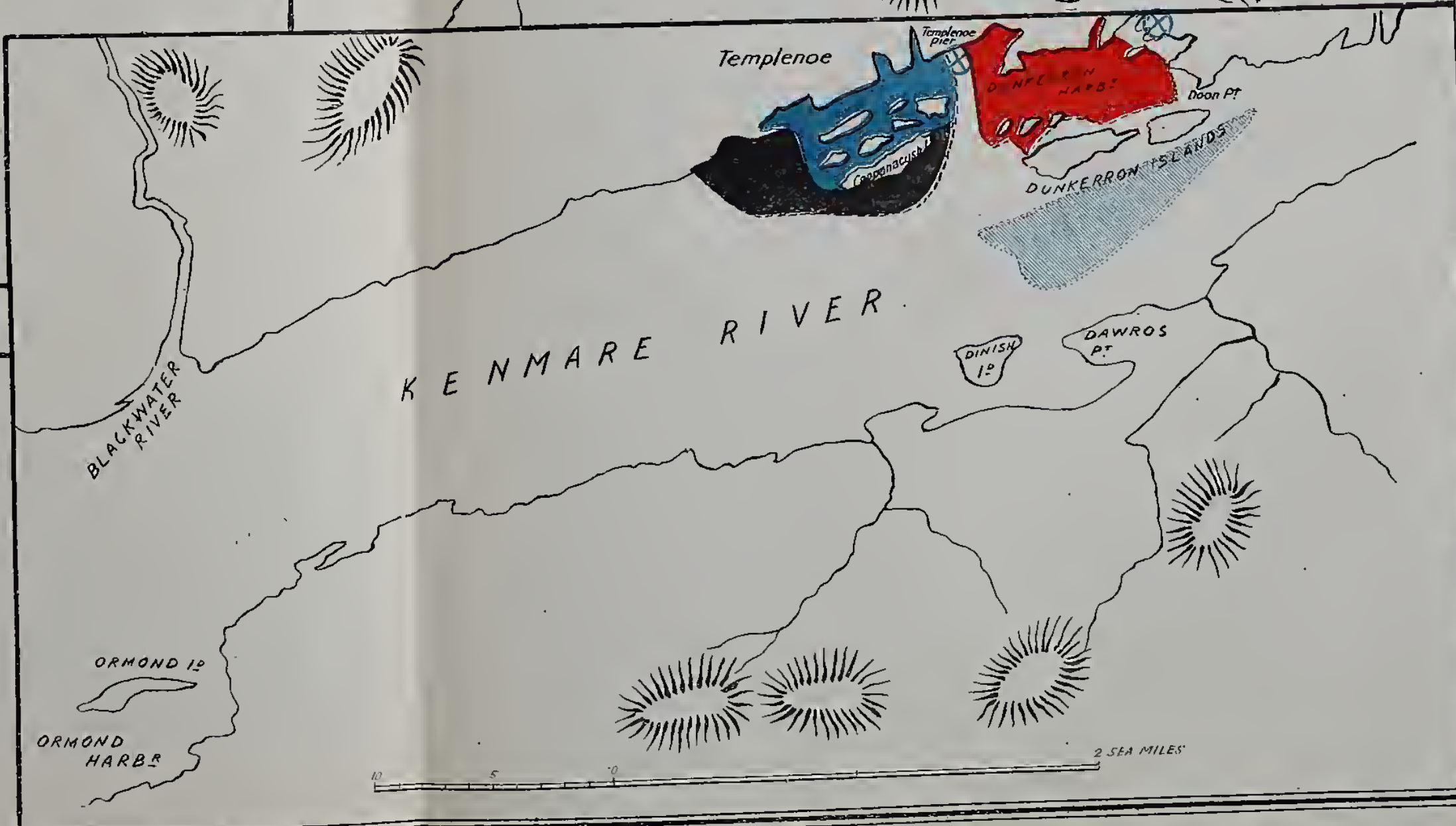
Licensed oyster bed No. 6 is owned by Mr. McClure, Dromore. The bed covers an area of 47 acres 2 roods, and extends from inside Cush Point on the west to Templenoe Pier, occupying the space between Greenane Island and the shore, and extending outside and around Greenane Island for a distance of about 200 yards. Portions of the bed are exposed at low water of spring tides. Only about 15 acres of the bed are planted with oysters, imported chiefly from Arcachon and Auray (France). About 250,000 were laid down four years ago. Oysters remain on the bed for two or three years. About 20,000 oysters disposed of annually during the season. They are hand-picked at low tides and placed in a concrete tank on the shore near low water mark from which they are taken as required and sent off packed in boxes to private customers in England and Ireland. None were sold to merchants during past season. The fall of spat on beds is inconsiderable. The bottom formation of bed is marl with a mixture of sand and mud overlying, and is kept regularly cleaned. The foreshore is covered with



KENMARE RIVER

MAP N^o 8.

- Sir John Colomb's Oyster Bed.
- Mrs Mahony's
- Mr McClure's
- Colonel Warden's
- Public Oyster Bed.
- Mr Heard's.
- Ardea Oyster Bed
- Sewage Outfalls.
- Surface Drainage Outfalls.



shingle and gravel. The bed is regularly worked, but only to a small extent. The oysters are fair sized, in good condition, and well flavoured. Two hands are employed on the bed.

The nearest sewer outfall is at Kenmare, five miles distant from the bed, and having regard to the large area covered with water in this portion of Kenmare River, and to the fact that the sewage matter passes in a very diluted form in the channel on the opposite side of the river nearly a mile distant from the bed, I consider this bed is not subject to pollution from this source. Pollution might, however, arise from the privies in connection with the Rossacussane National School, as they discharge directly into a small stream which enters the sea about three hundred yards distant from this oyster bed.

MRS. MAHONY'S LICENSED OYSTER BED.

This bed (Licence No. 5) lies outside Mr. M^cClure's bed and extends from a point on the shore a little to east of Cappanacush Castle ruin to Flag Point, covering the area between these points and between Cappanacush and Blangowla Island (see Map No. 8). The area of the bed is 165 acres 2 roods. The bed is exposed to the wash of the sea at low water, and owing to the muddy state of the bottom is not well suited for oyster culture. It has not been worked for the past three years. It is stated that about twelve years ago the bed was very productive and was used for growing and fattening oysters imported from Arcachon (France). There are very few, if any, oysters on the bed at present.

The same observations apply to this bed as regards pollution as to Mr. M^cClure's oyster bed adjoining.

ROSSDOHAN OYSTER BED. (Map No. 8.) Licence No. 155.

The licence includes in reality two separate oyster beds owned by Mr. Heard. One bed is situate off the point of Rosssdohan mainland, to the east of Rosssdohan Island. It is triangular in shape, with base of triangle towards shore, and has an area of about 50 acres. The second bed is situated in the channel leading from Coongar Harbour to the head of Drongawn Lough, and occupies the whole of the channel and lough from shore to shore. It is a little over 50 acres in extent. The bottom formation is in places a mixture of sand and mud, and in others mud only. The beds have not been worked for several years as oysters were poached. I am informed that there never was any trade done in oysters from these beds. They were used for private consumption.

The village of Sneem is about five miles distant from the beds, and Kenmare about twelve miles. There is no probability of the beds being subject to pollution.

DERRYQUIN OYSTER BED.—SNEEM HARBOUR. (Map No. 8.)

This oyster bed is owned by Colonel Warden, Derryquin Castle, and is not licensed. Colonel Warden is owner in fee of foreshore bounding the bed. The oyster bed is situate in the estuary of Sneem River, inside Finane Island, at top of Sneem Harbour, and extends up the river for some half mile. The area of the bed is about 100 acres, only a small portion of which is stocked with oysters. The bottom formation is composed of gravelly sand with a small admixture of mud, and is hard and firm and clean. Up to the year 1893, this bed was let to a company at a rent of £300 per annum, and was very productive. Since then it has only been worked for the private use of the family. The bed was used for laying oysters for fattening and growing purposes. 16,000 oysters from

Tralee Bay were laid on the bed two years ago. In former years oysters for layings were obtained from Arcachon (France) and were allowed to remain on the bed from two to five years. Portion of the bed is exposed at low water, at which time the oysters are picked. They are dredged from other parts. A concrete wall has been built at the point of low water of spring tides, where oysters are laid when picked or dredged, so as to be available when required. In the deepest part of the bed there are about six feet of water at low tide. Very little fall of spat observed. The spat is carried out to sea by the current in the river.

The only possible pollution to which the bed is subject is the drainage from the village of Sneem, which is about two miles further up the river. The population of the village is about 200, and the drainage consists merely of surface water and slops. I am informed that there are no water-closets in the village. The possibility of contamination of the bed is, therefore, very remote.

ARDEA OYSTER BED.—KILMAKILLOGE HARBOUR, KENMARE RIVER. (Map No. 8.)

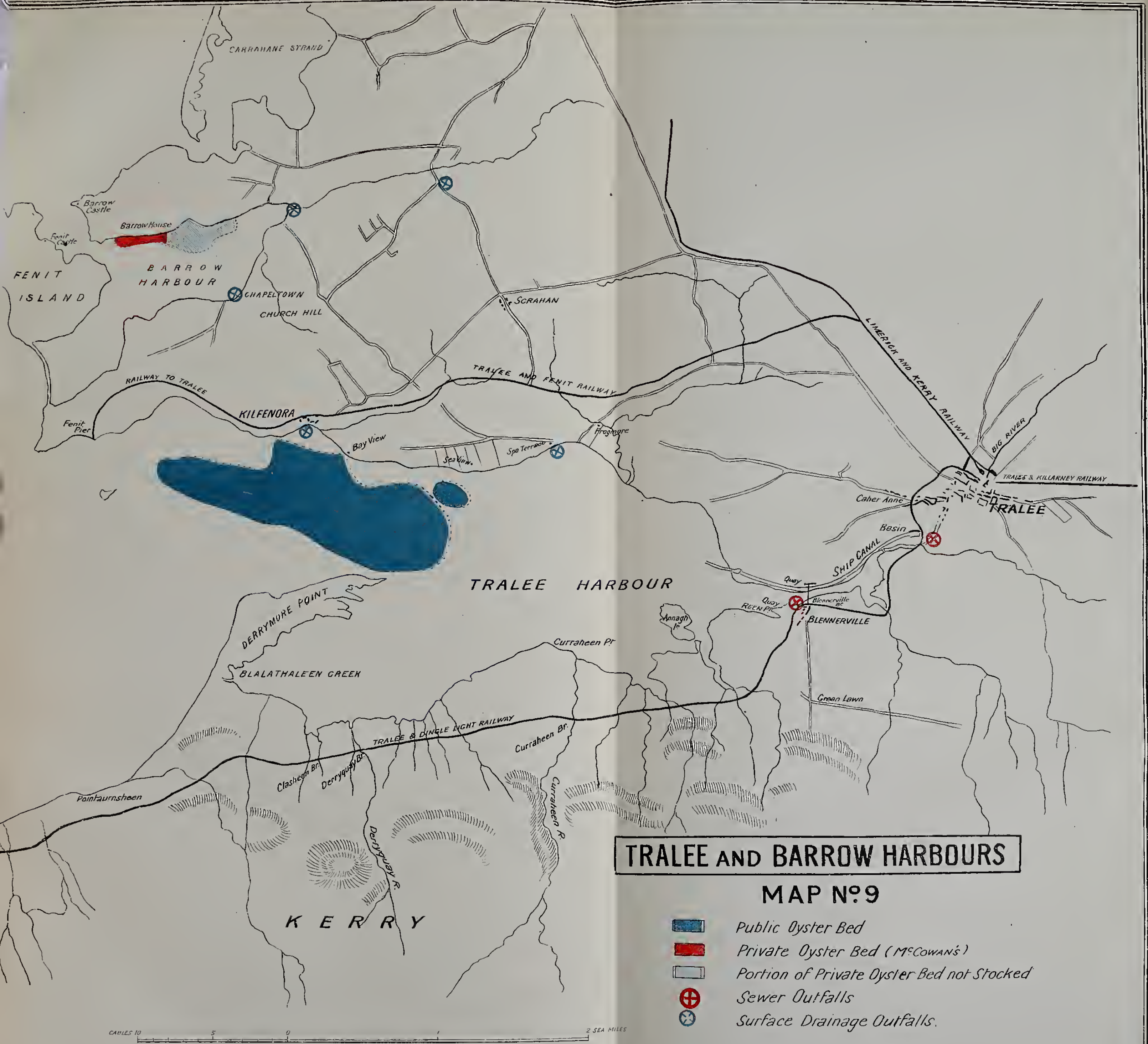
This oyster bed is situate in Kilmakilloge Harbour between Doorus Point and Derreen, and is about 10 acres in extent. A mountain stream enters the harbour close to the bed. Portion of the bed is exposed at low water. The bed is fairly stocked and used for laying oysters, which are got from Brittany and from Tralee Bay, and remain on the bed from two to five years to grow and fatten, for which purpose the bed is well adapted. Very little fall of spat observed—it is said to be carried off by the current in the river. The bed is very clean, the bottom being sandy, with a little mixture of mud. It is not licensed; Lord Lansdowne is the owner by prescriptive rights; Mr. Brennan has worked it for the past twenty years. Four persons are employed dredging and picking oysters, &c., from 1st September to 30th April. The yearly output of oysters averages 130,000. The oysters are taken direct from the bed, packed in boxes with seaweed, and sent off by rail almost daily during the season to customers in London, Dublin, Cork, and elsewhere. The only source of pollution in the case of Kilmakilloge Harbour is a surface drain conveying the overflow from a cesspool which receives the drainage from Derreen House. The cesspool is about 300 yards from the seashore, and the drain is an open one for a considerable distance before entering the sea. The point where it discharges is about 300 yards from the nearest point of the bed. Derreen House is occupied only for six or seven months each year, so that the quantity of sewage entering the sea near the oyster bed is extremely small, and as the expanse of water at the point of outfall is so great as to render the chances of pollution very remote.

PUBLIC OYSTER BED.—KENMARE RIVER. (Map No. 8.)

This oyster bed is situate in Kenmare River to the south of Dunkerrin Island. It is about a mile and a half in length and half a mile broad, and is situate in deep water. Two or three boats are employed occasionally dredging for oysters during the season. The take of oysters averages a few thousands annually, the purchasers being local dealers who send them off by rail to Cork and Dublin to retail dealers. The oysters are raised from spat, but are not very plentiful of late years. The bottom formation of this bed is somewhat similar to that of the licensed beds close by, and the same observations apply as regards possible contamination.



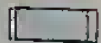


OTHER SHELL-FISH.

Periwinkles are collected on the shores of Kenmare River. About thirty tons (packed in bags) are sent off annually to Billingsgate Market. No other kind of shell-fish is taken from the Kenmare River.



TRALEE AND BARROW HARBOURS

MAP N°9

-  Public Oyster Bed
-  Private Oyster Bed (McCOWAN'S)
-  Portion of Private Oyster Bed not Stocked
-  Sewer Outfalls
-  Surface Drainage Outfalls.



TRALEE BAY.

Tralee Bay, an inlet of Ballyheigue Bay, opening off the Atlantic Ocean, on West Coast of County Kerry, is about eight miles in length by two miles in breadth. It is navigable for small vessels as far as Blennerville, and from thence to Tralee by canal. Large vessels do not proceed further up the bay than Fenit, near its entrance, where there is a Pier and Railway Terminus.

PUBLIC OYSTER BED, TRALEE BAY. (Map No. 9.)

GENERAL DESCRIPTION.

This oyster bed is in Tralee Bay, Tralee Rural District, and extends for about two miles from a point opposite Spa Lodge, on the northern shore of the bay, to within half a mile of Fenit Pier, approaching to near low water mark on both sides of the bay. Opposite Derrymore Point oysters can be picked by hand at low water of spring tides, and are collected by the residents in the neighbourhood, who vend them in Tralee during the season. Many of these oysters so collected are very small and are sold at a very cheap rate. The bottom formation of the bed is a sandy silt and is kept clean by constant dredging during the season. The oysters are raised entirely from spat, of which there is a very considerable fall every year during spatting season.

EXTENT OF INDUSTRY.

The bed is very productive. From 1st November to 10th March about 3,000,000 oysters are obtained. Twenty boats, each having a crew of three hands, are employed dredging; the take of each boat daily averages about 1,000 oysters, which are sold to local dealers for 1s. 6d. per hundred. Only a small proportion of the oysters are fit for market. These are sold locally or else sent to Dublin, being packed in boxes and forwarded by rail direct from the bed on the same day as they are landed from the boats. The vast majority of the oysters are disposed of to owners of private oyster beds around the coast of Ireland for relaying on their beds to grow and fatten. The principal purchasers of these oysters during the past season were Lord Barrymore, Cork; Mr. Baker, Rosses Point, Sligo; Mr. Jackson, Clifden; Mr. Phibbs, Sligo; Mr. McClure, Kenmare; Burren Fishery Company, Galway Bay; Mr. Brennan, Derreen; Sir J. Colomb, Kenmare, Major Newenham, Coolmore, Cork, &c.

Possible Sources of Contamination.

The sewage of the towns of Tralee and Blennerville is discharged in its crude state direct into the River Lee, flowing into the bay. The sewage of Tralee passes into the river at a point four miles distant from the nearest point of the bed. The Blennerville sewer outfall is three miles distant from the bed. The combined population of these towns is about 9,500. Tralee is to a considerable extent drained on the water carriage system. There are very few water-closets at Blennerville. There is a very large expanse of water at the site of the oyster bed at full tide, the depth ranging from two to over twelve fathoms. I think, however, that this oyster bed cannot be considered free from risk of pollution.

BARROW HARBOUR.—OYSTER LAYING. (Map No. 9.)

There is one licensed oyster bed in Barrow Harbour, owned by Mr. McCowen, Tralee. It is situate on the northern shore of the harbour inside Fenit Island. The area of the bed is 81 acres 1 rood and 26 perches. Less than ten acres of the western portion of the bed only is stocked with oysters. The bed is exposed at low water of spring tides, and extends for about twenty yards from ordinary low water mark into the harbour. The oysters are picked by hand at low tides, and placed on the shore above low water mark so as to be available when required for market. The bottom formation is

a hard sand with a little admixture of mud. The greater portion of this licensed bed is too sandy for laying oysters, and consequently is not utilised. The portion utilised is entirely used for laying oysters for growing and fattening purposes. The stay of oysters on the bed ranges from six months to one year. The oysters for planting are obtained from the neighbouring bay (Tralee). Mr. McCowen employs six boats dredging in Tralee Bay for the purpose of stocking this bed. The number of oysters taken from the bed and disposed of during the past season was close on 200,000. The trade done is a retail one. The oysters are taken direct from the bed, packed with seaweed in small wooden boxes, each box containing from 50 to 100 oysters, and sent by rail to customers, numbering about 500, in different parts of Ireland and England. Great care is taken in the handling and picking of the oysters. The bed is very clean and the oysters are of medium size, fairly plump, and well flavoured.

Possible Sources of Contamination.

The overflow from a cesspit into which Mr. McCowen's house is drained is discharged on the shore about 300 yards distant from the nearest point of the oyster bed. This house is occupied only during the summer months during the close season for oysters. The effluent is so very inconsiderable in quantity as to be scarcely likely to affect the oyster bed. Mr. McCowen informed me that he would take immediate steps to prevent any possible pollution from this source. There are no other sewer outfalls in Barrow Harbour, the only drainage being surface, from a few fishermen's cottages at the opposite side of the harbour from the bed, and from a creamery about one mile distant. Tralee is about twenty miles distant by water, and the sewage from it could not affect the bed. I consider there is little risk of this oyster bed being polluted during the open season for oysters, and when the cesspit into which Mr. McCowen's house is drained has been removed, and any possible contamination from this source obviated, there should be no risk of pollution.

MUSSEL BEDS, CASTLEMAINE HARBOUR, COUNTY KERRY.
(Map No. 10.)

Castlemaine Harbour is situate at the head of Dingle Bay on the Estuary of the River Maine.

There is a very productive mussel bed in Castlemaine Harbour extending from Reen Point to Lack and Inch Points and around by Cromane Point. Some two hundred persons are employed dredging for mussels from 1st October in each year till the middle of March following. About 500 tons weight of mussels are obtained from the bed on an average each season, and are bought by local dealers or sent off by rail, in bags, to wholesale dealers in Bradford, Birmingham, Liverpool, Manchester, Nottingham, &c. Latterly there has been a falling off in the quantity of mussels obtained from the bed due probably to overdredging. The mussels are of good quality, and are said to be used as food, but are eaten cooked.

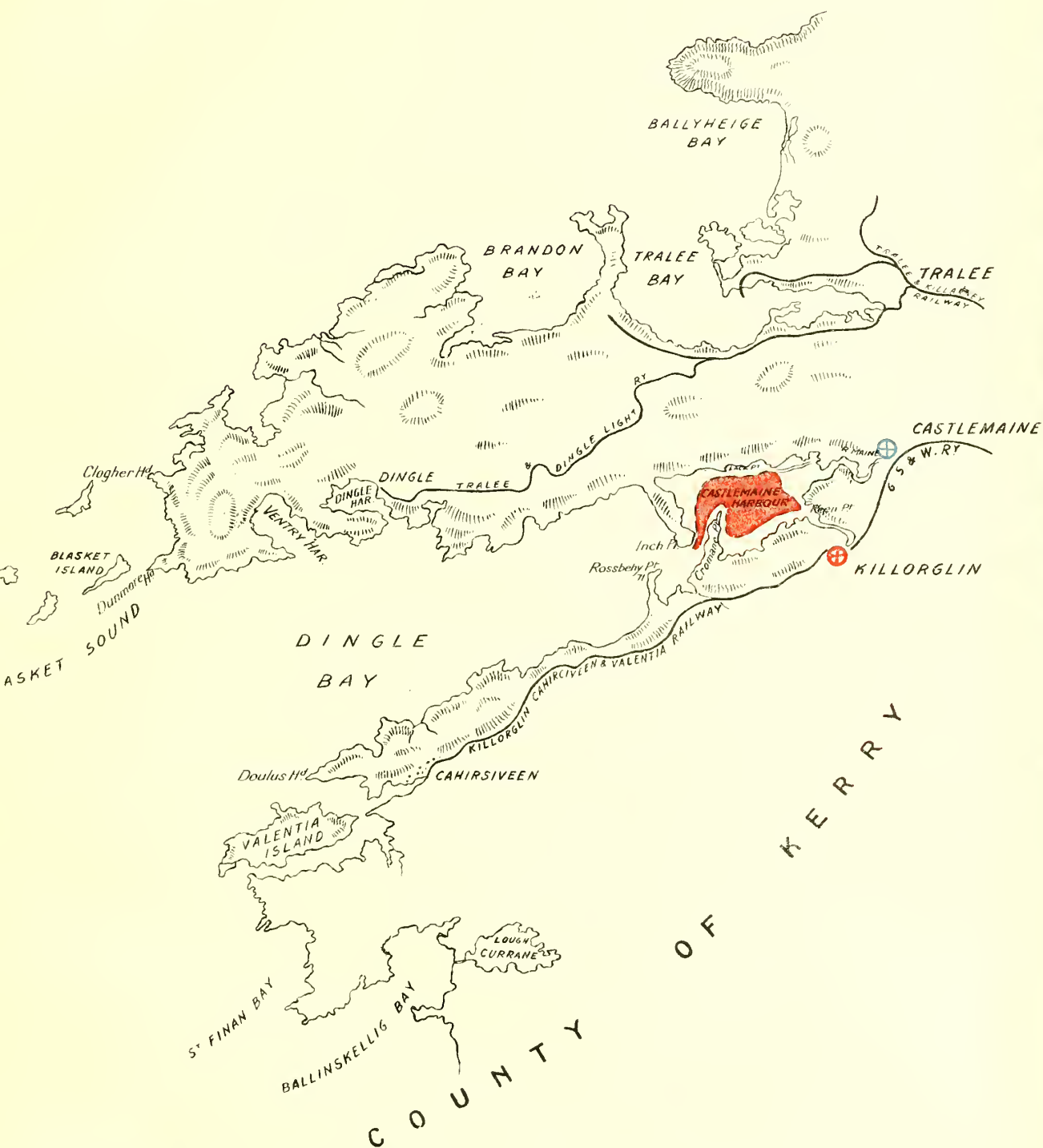
The nearest possible source of contamination is the town of Killorglin, the sewage from which is discharged into the River Laune, about three miles from the nearest point of the mussel bed. The population of Killorglin is 1,178. The town is not drained on the water carriage system, and the risk of pollution from this source is, in my opinion, very small.

PERIWINKLES, KERRY COAST.

Periwinkles are gathered in Dingle, Tralee, and Ballyheige Bays all the year round. About 150 persons are engaged picking them off the strands at low water. About 120 tons are annually exported, chiefly to Billingsgate Market.

COCKLES.

Very few cockles are picked on the coast of Kerry, except on the strands in Dingle District. They are sold locally by gatherers, but are previously cooked. A very small trade is done.



KERRY HEAD TO VALENTIA.

MAP N^o 10.

- Mussel Bed.*
- + *Sewer Outfall.*
- + *Surface Drainage Outfall*

CABLES 70 60 50 40 30 20 10 0 70 140 CABLES



ESTUARY OF RIVER SHANNON.

LISTOWEL RURAL DISTRICT. (Map No. 11.)

There are four licensed oyster beds in the River Shannon. Nos. 84, 158, and 162 are situate on the northern, eastern, and southern shores of Carrig Island, and No. 78 on the shore between Richards Rock and Knockfinish Point on the mainland to the east of Carrig Island.

The three licensed beds on Carrig Island shore are owned by Mr. Charles Sandes; only the portion of No. 84, coloured red on map, is stocked. The other two oyster beds have not been worked for some years and are practically derelict, owing, I understand, to their unsuitability for oyster culture. No. 84 bed is 56 acres in extent, of which about 15 acres is stocked. No. 158 bed contains 217 acres, and No. 162 bed 40 acres 2 roods and 27 perches. There are no oysters on the two last mentioned beds. They are exposed at low water of spring tides, and portions of them at ordinary low water. The ground formation is a mixture of gravel, sand, and mud; it is fairly firm in the case of No. 84 bed, but the bottom of the other two beds is rather soft, mud preponderating.

The portion of No. 84 bed, which is stocked, lies to the west of Saint Sennaan's Road, and occupies a narrow strip of shore at low water of spring tides. It is used for laying oysters for fattening, and is said to be well adapted for this purpose. It was not worked for some years prior to 1901, when 10,000 oysters were planted; in 1902, 8,000 more were laid down, and during the past season 28,000 were laid. The oysters were got from Tralee Bay public bed, and with the exception of about 8,000 picked during the past season and disposed of, the remainder are still on the bed, and will not be taken up until fit for market—probably from one to three years.

The oysters are taken direct from the bed, packed in small boxes, and sent by parcels post to private customers in England and Ireland. A very limited business is done. They are fair sized and in excellent condition. The bed is regularly cleaned and cleared of seaweed, &c., which can be easily done when the bed is exposed at low water of spring tides.

As regards the possibility of pollution, the nearest sewer outfall is at Ballylongford village, which has a population of less than 600, and is three miles distant from the nearest point of the oyster bed. There is practically nothing but surface drainage from the village, and the possibility of the bed being contaminated from this or any other source may be regarded as very remote, particularly as it is protected by Saint Senaan's Road.

Number 78 licensed oyster bed, owned by Mr. Collis, situate between Richard's Rock and Knockfinish Point, area 212 acres, extends outwards towards sea from the foreshore for a distance of about a quarter of a mile. The greater part is exposed at low water of spring tides. Some oysters are, I am informed, found in the deeper portion of the bed which is dredged by local fishermen. (This portion is marked blue on Map No. 11.) The bed has not been stocked for years, and is practically derelict. As regards the possibility of contamination, the same observations apply as to Mr. Sandes' oyster bed, No. 84, previously referred to.

PUBLIC OYSTER BEDS.—RIVER SHANNON. (Maps Nos. 11 and 12.)

There are several public oyster beds on the River Shannon, those on the southern side lying between Carrig Island and Foynes, in Ballylongford Bay, Glown Clonsagh Bay, Tarbert Road, and from Glin to near Foynes; and those on the northern side being situate in Labbasheeda Bay, Cloon-derlaw Bay, Ballymacrinan Bay, Moyne Bay, Scatterry Road, and to the west of Scatterry Island, from Baurnahard Point to Corlis Point.

Commencing on the west, on the southern side of the River Shannon, there is a public oyster bed situate off Corran Point, Carrig Island, in Listowel Rural District. It is about one mile long by a quarter of a mile in breadth, extending from near low water mark to between two and four fathoms of water. The second public bed is in Ballylongford Bay, Listowel Rural District, and extends from the extremity of Saint Senaan's Road to Knockfinlish Point, taking in portion of Mr. Collis' licensed bed. Its length is about one mile, and it extends from low water mark towards the channel of the river for about a quarter of a mile.

The third public bed is in Glown Clonsagh Bay, Listowel Rural District, and is about half a mile in length by about a quarter of a mile in breadth, and extends from near low water mark towards the channel of the river to about four fathoms of water.

The fourth public bed is in Tarbert Road, Listowel Rural District, and extends from within a quarter of a mile of the Pier on Tarbert Island to Ballydonoghoe Point, occupying a narrow strip outside low water mark for about one mile in length.

The fifth bed commences a little to the east of Glin village, and extends for about five miles to a point opposite Mount Trenchard, within two miles of Foynes village, in the Glin and Rathkeale Rural Districts (see Map No. 12). The depth of water on this bed averages from one to seven fathoms of water at low tide.

On the County Clare side of the River Shannon, commencing from the east, there is a public oyster fishery in Labbasheeda Bay, Killadysert Rural District, extending from Dillisk Rock to near Red Gap Point (see Map No. 12); it is about a mile in length and a quarter of a mile broad, in a depth of water averaging from one to four fathoms at low tide; the bed is nearly one mile distant from Labbasheeda village.

The next oyster fishery is in Cloonderlaw Bay, Killadysert Rural District, and occupies the whole of the bay outside low water mark and between Kilkerrin Point and Burraun Point (see Map No. 11).

Another oyster fishery extends from the eastern extremity of Ballymacrinan Bay to near the lighthouse on Scatterry Island, a distance of over three miles (see Map No. 11), in Kilrush Rural District. It varies from a quarter to half a mile in breadth from low water mark in Ballymacrinan and Moyne Bays and on the shores of Hog Island and Scatterry Island, eastern side. There is, in addition, a public oyster bed to the west of Scatterry Island, extending from Baurnahard Point to Corlis Point in Kilrush Rural District, portion of which only is shown on Map No. 11. The extent of the bed is about two miles in length and a half a mile in breadth from low water mark towards the channel of the River Shannon.

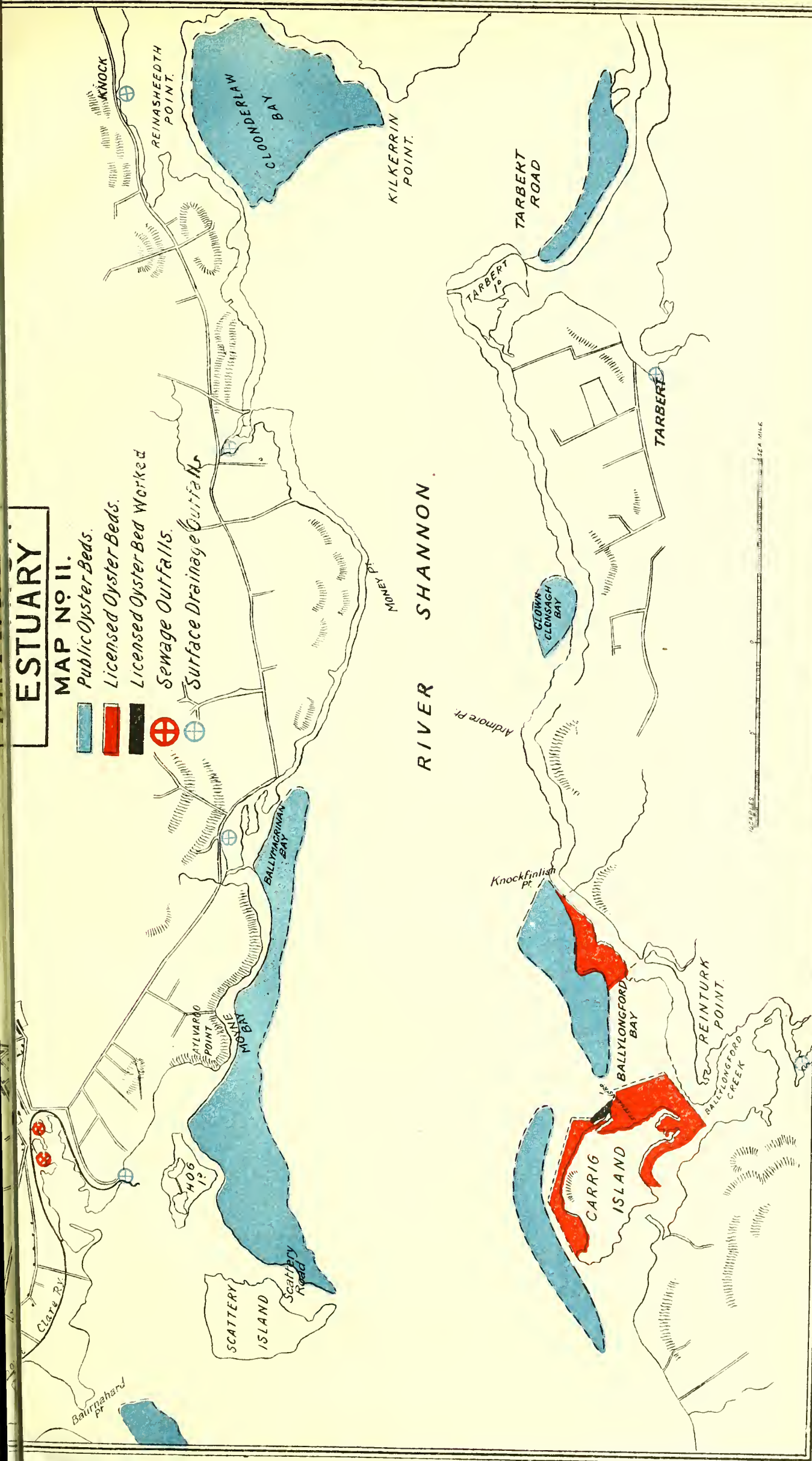
EXTENT OF INDUSTRY, &c.

Ten boats, each having a crew of three hands, are employed occasionally from the 1st September till the 30th April dredging for oysters on the public beds in the River Shannon. The take of oysters by each boat would average about 100 weekly during the past season. Total, about 8,000 oysters for season. The oysters are sometimes kept for two or three days in the fishermen's boats until a sufficient number has been taken, when they are sent off to Limerick by steamer to dealers, being packed in bags generally. The greater number of the oysters are sold locally by hawkers in Kilrush, Kilkee, Ennis, and Listowel, or are disposed of to local dealers at these places. The yield is very small having regard to the extent of the beds. The most productive bed is that in Labbasheeda Bay. The oysters are fair sized, averaging over three inches in diameter, and are said to be well flavoured and in good condition. The beds have probably been over-dredged in former years, which accounts for the small yield at present. The fall of spat is variable. The beds are said to be clean, with a firm bottom of sand and little admixture of mud.

ESTUARY

MAP NO II.

- Public Oyster Beds.
- Licensed Oyster Beds.
- Licensed Oyster Bed Worked
- Sewage Outfalls.
- Surface Drainage Outfalls.

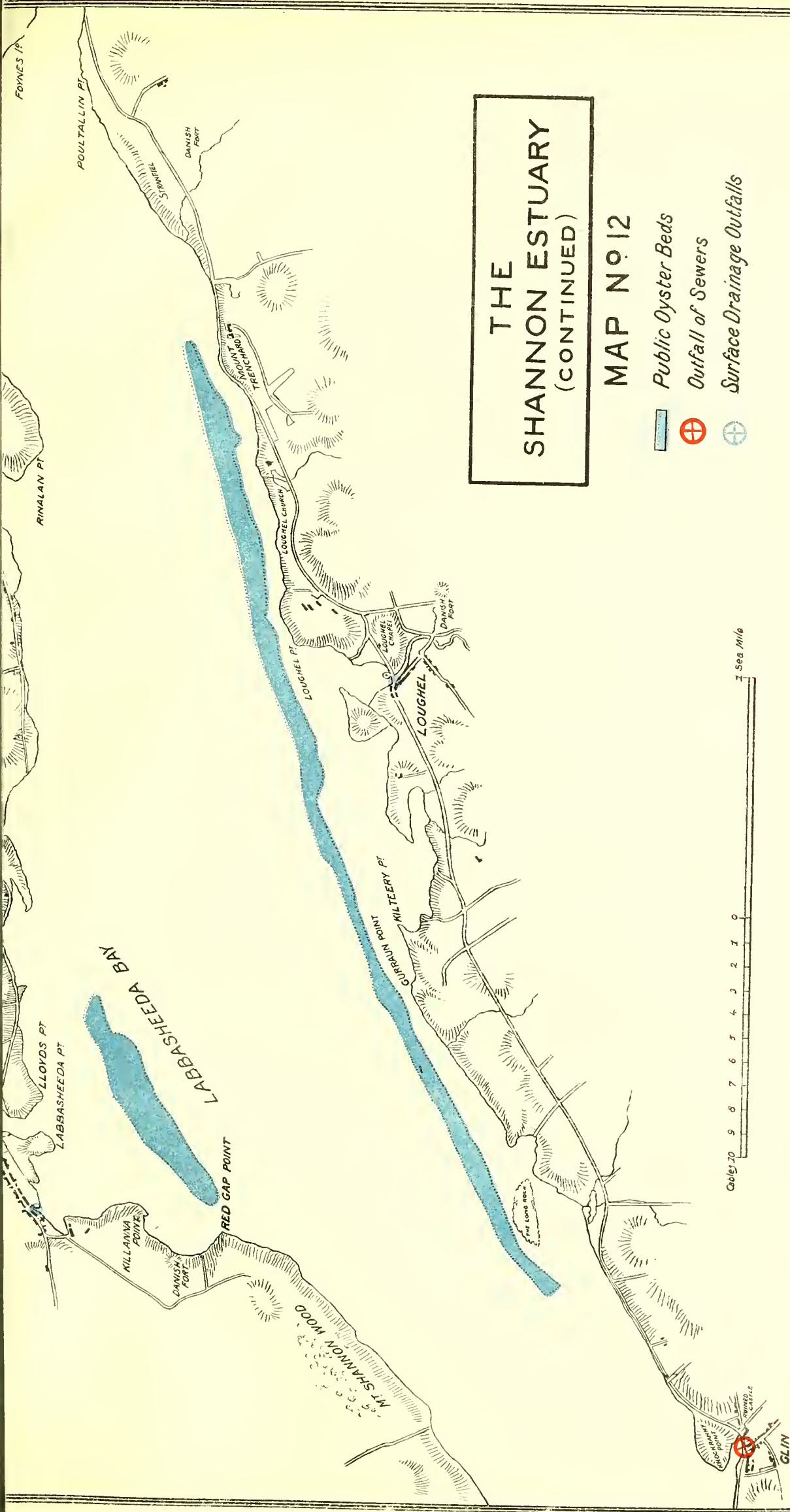


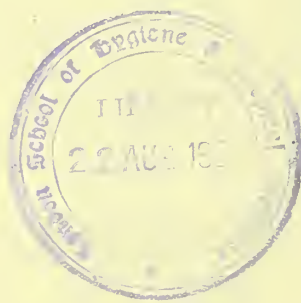


THE
SHANNON ESTUARY
(CONTINUED)

MAP No. 12

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Possible Sources of Contamination.

The sewage from the City of Limerick, having a population of 45,806, is discharged in its crude state into the River Shannon by several outlets about thirty miles above the nearest point of the public oyster beds below the village of Foynes. There is a great extent of water in the river where the oyster beds are situated, and having regard to the great distance from Limerick, I consider that contamination of the beds from this source is a very remote possibility and need scarcely be taken into consideration. The sewage of the town of Ennis (population, 5,460), also finds its way into the River Fergus, a tributary of the Shannon, but at such a distance from the nearest oyster fishery—between twenty and thirty miles—that there would appear to be no risk of pollution from this source. Kilrush is the next most important town with sewer outfalls on the River Shannon. The sewage is discharged in its crude state near the Quay, Kilrush, which is about two miles from the nearest point of the public oyster bed. The sewage would, in the natural course, find its way through Kilrush Channel to the sea and not touch on the oyster beds; there is, however, a remote possibility of some of the sewage finding its way to the nearest beds by being carried back on flood tides, but this is, I think, very improbable. The population of Kilrush is 4,095. The town is only very partially drained on the water-carriage system, and the quantity of excrementitious matter discharged into the river is small. The village of Foynes drains into the Shannon about two miles from the nearest point of the beds; the population of the village is 249. Only surface water and slops constitute the effluent except from two or three water-closets. The sewage from the village of Glin is discharged into the Shannon about half a mile below the nearest point of the bed, but soon finds its way into deep water, and is carried out to sea without, in my opinion, coming into contact with the bed. The population of Glin is about 500, and very little sewage matter of a nature likely to pollute oyster beds is contained in the effluent.

The village of Tarbert, with a population of 552, has its sewer outfall about one mile or a little over from the nearest point of the oyster fishery in Tarbert Road. The same observations with regard to the sewage apply as in the case of Glin.

Ballylongford, with a population of 595, is about three miles from the nearest oyster fishery. The sewer outfall is close to the town. The effluent is composed chiefly of slops and surface water, as there are only two or three water-closets in the village. I consider there is very little risk of pollution of the oyster beds from this or any other source.

PERIWINKLES.

Besides oysters, periwinkles are the only other kind of shell-fish collected on the Shannon and sent off for sale. About fifty tons annually are picked on the shores of the River Shannon at low water, and shipped from Tarbert and Kilrush in bags to the Billingsgate Market. The periwinkles are not picked near any of the sewer outfalls, and there seems little risk of pollution. These shell-fish are always cooked before being eaten.

COASTS OF COUNTIES OF GALWAY AND CLARE.

GALWAY BAY OYSTER FISHERIES.

Maps Nos. 13 and 14.

Galway Bay is included in a line drawn from Black Head in County Clare to Spiddal, County Galway, and extends inwards for a distance of over thirty miles to the mouth of Oranmore River. Its breadth varies from twelve to sixteen miles. The depth of water varies from fifteen fathoms at the entrance of the bay to one fathom or less at its head, and along the coast line where there are several smaller bays, creeks, and islands. The oyster beds are situate in the smaller bays and creeks and around some of the islands.

PUBLIC OYSTER FISHERIES.

There are four public oyster fisheries within the bounds of Galway Bay, viz.—One off Rinmore Point (Galway Harbour), one in Oranmore Bay, one in Tyrone Pool (Rincarna Bay), and one in Kinvarra Bay.

PUBLIC OYSTER FISHERY OFF RINMORE POINT.

(Map No. 14.)

This oyster bed is situate in Galway Harbour at the mouth of the River Corrib, and within 300 yards of Galway Dock, Galway Urban District, in the channel between Nimmos Pier and Rinmore Point, but nearer to the latter. Its area is about five acres. There are from six to ten feet of water over the bed at low water. The bottom is a mixture of gravel, sand, and mud, and is weedy and covered with debris carried down by the River Corrib. The oysters on this bed are raised from spat, of which there is a very indifferent fall. In any event, the current from the river is so great that the spat would not be retained on the bed. There are very few oysters to be had from this bed. The open season for this and for the other natural beds in Galway Bay is only during the month of December. Three boats were engaged dredging for oysters. During the month of December last, I am informed, that only about 5,000 oysters were taken. These were sold locally in Galway, and about 500 to Mr. Lenehan, Clarenbridge, for relaying. The oysters are fair sized and in good condition.

Possible Sources of Contamination.

There is little doubt that this bed must be subject to pollution to a very serious extent, as the sewage of Galway is discharged into the River Corrib at several points in its course through the town, one of the outfalls being at the dock, within 300 yards of the bed. There are other sewer outlets not far distant from the bed, viz.:—At Lough Atalia, and from Rinmore Military Barracks.

MUSSELS.

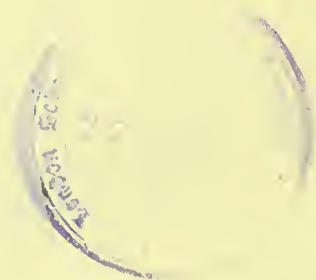
Mussels are also dredged and picked from the rocks within a few yards of the dock (see map No. 14). The trade, however, is very small. The same observations as regards pollution apply as in the case of the oyster bed.

ORANMORE BAY PUBLIC OYSTER BED.—GALWAY RURAL DISTRICT.

(Map No. 13.)

This natural oyster bed occupies nearly the whole of Oranmore Bay from Rusheen Point outwards, covering an area of several thousand acres and extending to low water mark around the shores of the bay. The bottom formation is a mixture of gravel, sand, and mud, and is rocky in parts, which renders dredging difficult; the ground is clean and healthy. The bed is dredged by about seven boats during the month of December, and oysters:





are picked up at low water of spring tides. At other times, I am informed, the take of oysters by the boats amounts to about 10,000. These are sold by the fishermen to local dealers, who send them off direct to the Dublin market, principally to the Burlington, Bailey, and Red Bank Restaurants. The oysters are raised from spat, of which there is said to be a very good fall, and are large-sized and very good in quality.

Possible Sources of Contamination.

The only pollution entering Oranmore Bay is from the village of Oranmore, which has a population of about 150. This consists, however, of nothing but surface drainage and slop water discharging into the river close to the bridge at Oranmore, and about one mile from the nearest point of the oyster bed. Galway is about four miles distant from the nearest point of the bed. I do not consider that there is any risk of pollution from this source owing to the distance and situation of the bed from Galway, and to the fact that the sewage effluent from Galway is conveyed by the current in an opposite direction to the bed.

STRADBALLY PUBLIC OYSTER FISHERY.

GALWAY RURAL DISTRICT. (Map No. 13.)

This natural oyster bed is situate in Tyrone Bay, extending from Bird Island to the junction of the Kilcolgan and Clarin Rivers, a distance of a little over one mile. It covers the centre of the bay, reaching to within ten yards of low water mark on the northern shore, and approaching close to the Tyrone private oyster bed on the southern shore of the bay.

This is one of the most prolific oyster beds on the coast of Ireland, and ranks next to the public oyster bed in Tralee Bay as a spatting ground. The oysters are small, and sold for stocking other oysters beds around the coast as they are too small for the market, being only from one and a half to two and a half inches in diameter. The bed is dredged only during the first ten days in the month of December, from 150 to 200 boats being engaged in dredging operations, and the number of oysters taken amounting to about 300,000. The bottom of the bed is hard, consisting of a mixture of sand, gravel, shells, and mud, and is very clean and apparently well adapted as a breeding ground. I was informed that sometimes the fishermen, when the price of the oysters is low, lay the oysters they dredge from this bed at low water mark on the shore opposite their holdings until a better price is obtained, and that the oysters remain for some weeks in those places before being disposed of for laying. There is usually a good demand for oysters from this bed for laying, as they appear to do well when laid on other beds around the coast.

Possible Sources of Contamination.

The only pollution entering Tyrone Bay is surface and slop water from the villages of Clarenbridge and Stradbally, and a few scattered houses at the Weir and Kilcolgan Bridge, all of which are over one mile distant from the nearest point of the bed. The population of all these places would not amount to more than 120. I do not consider that there is any risk of contamination of this oyster bed.

CRUSHENA PUBLIC OYSTER BED.

GORT RURAL DISTRICT. (Map No. 13.)

This oyster fishery is situate in Kinvarra Bay, between the southern extremity of Mulronev Island and Madden's Rock. It occupies the whole of the bay between these points, and extends on either side to low water mark of spring tides. The bed is nearly one mile in length and about a quarter of a mile broad. The ground formation is a mixture of sand, gravel, and shells, with a little mud. The oysters are raised entirely from spat, of

which there is said to be a considerable fall each season. The tenants of the townland of Crushena look upon this oyster bed as their private property, and do not permit any outsider to take oysters from it. There are twenty-one tenants on the townland, and the profits from the fishery are shared amongst them. Four boats, each having a crew of six men, dredge the bed during the month of December. About 100,000 oysters are taken. The larger ones are sold to local dealers for market, some being sent off direct to Mussen and Company, Liverpool, while the smaller oysters, which form the greater number, are disposed of for stocking the oyster beds in the locality. Any oysters not disposed of at once are placed in a ring at low water mark, close to the Quay, inside Mulronee Island, where they remain sometimes for six weeks before being sold. The ring is on a sandy bank, and far removed from any source of pollution.

Possible Sources of Contamination.

The only drainage entering this bay is from the village of Kinvara, which has a population of about 200. There are no water-closets connected with the drains, which discharge surface and slop water about one mile from the nearest point of the oyster bed. I consider this oyster bed free from any risk of pollution.

PRIVATE AND LICENSED OYSTER BEDS.

There are ten private oyster beds situate in the various smaller bays and inlets of Galway Bay.

ARDFRY OYSTER BEDS.

GALWAY RURAL DISTRICT. (Map No. 13.)

These licensed oyster beds (Nos. 149 and 33) are situate in New Harbour and Mweeloon Bay, and extend around Ardfry Point. The beds occupy the whole of New Harbour below low water mark, and the greater part of Mweeloon Bay on the northern shore, extending from low water mark to about the centre of the channel to a point opposite Toberavennan, and, from this point, the whole of the bay up to Kilcaimin. The total area covered by the beds is close on 2,000 acres, but only about 100 acres are cultivated. Lord Wallscourt is owner of the beds and Mr. Hill, manager. Six men and three boats are employed on the beds, dredging, &c., and keeping them clean and free from weeds. A great part of the beds is very weedy and stony. The ground in the parts worked is composed of a mixture of gravel, sand, and mud, and is kept clean and free from weeds. The oysters are raised from spat, of which there was a great fall four years ago, but it has been smaller since then. No oysters were laid on the beds for several years. During the past season about 200,000 oysters were dredged; they are sent chiefly to private customers packed with seaweed in small boxes or hampers direct from the beds. Oysters grow and fatten well on these beds.

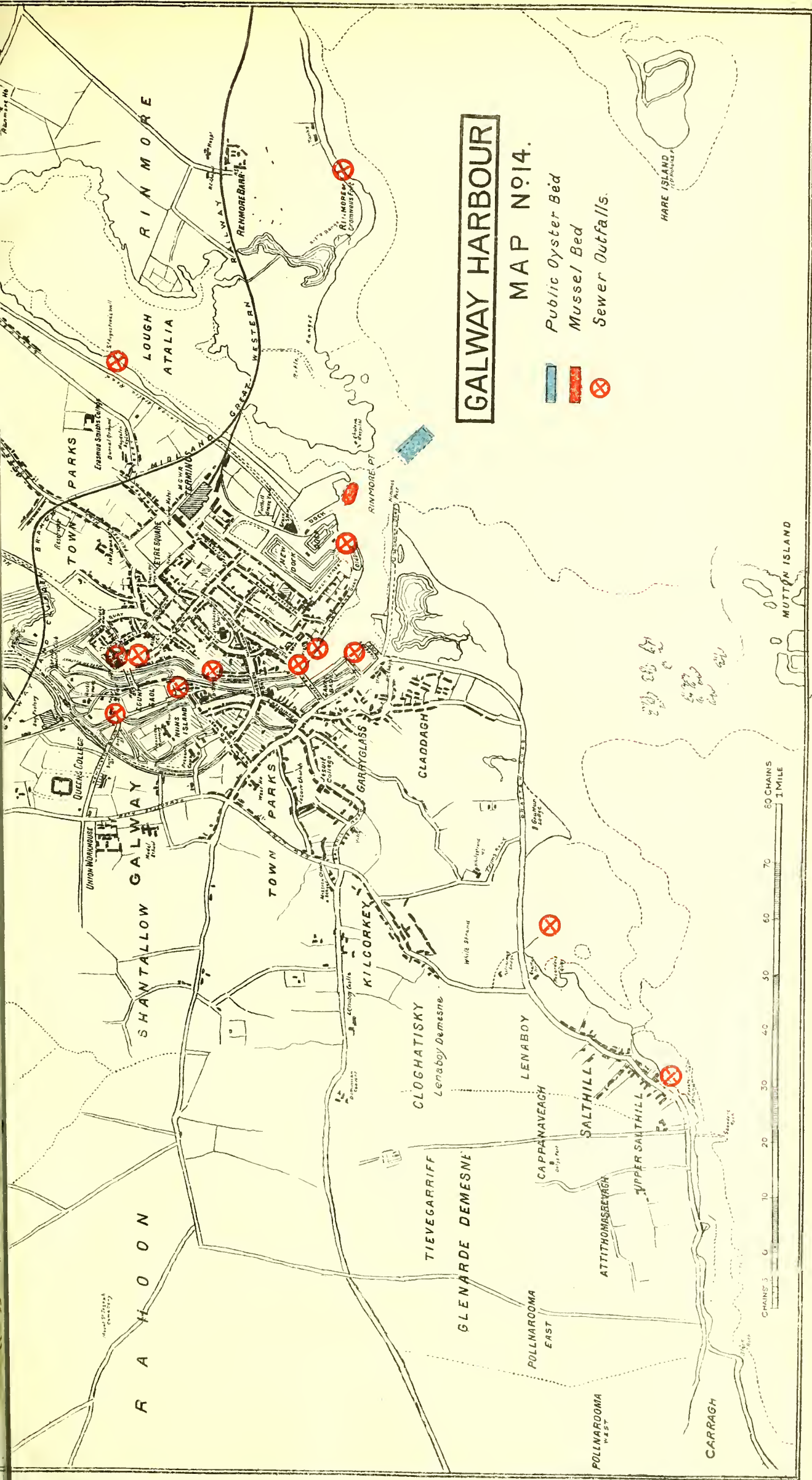
Possible Sources of Contamination.

There are no local sources of pollution. The nearest sewer outfalls are at Galway, four miles distant across the bay, but as the sewage effluent is carried by the current in an opposite direction to the beds, there appears to be no risk of contamination from this or any other source.

BALLYNACOURTY OYSTER BED.

GALWAY RURAL DISTRICT. (Map No. 13.)

The owner of this oyster bed is Mr. O'Flaherty, who resides in Australia. The bed, which is not licensed, is situate in Ship Pool inside Mweenish Island and Carrowmore. It is about ten acres in extent, extending upwards from ordinary low water mark. At low water of spring tides the bed is nearly all exposed. It has not been worked for the past two years. In 1901, about 20,000 oysters were taken off the bed, in fact it was then cleared of



GALWAY HARBOUR

MAP No 14.

- Public Oyster Bed
- Mussel Bed
- Sewer Outfalls.

CHAINS 0 10 20 30 40 50 60 70 80 CHAINS
1 MILE



oysters, and at present none are to be got from it. The oysters were raised from spat, and the bed was fairly productive in former years, the annual output amounting to from 10,000 to 15,000 oysters, which were disposed of to local dealers, who sent them to Dublin. The oysters were always picked by hand at low water and sent off direct from the bed.

The bed is not at present clean, being covered with sea-grass and weeds. The bottom is a mixture of sand and mud, the latter preponderating, which causes the bed to be soft and unsuitable in its present state for oyster culture.

Possible Sources of Contamination.

The nearest sewer outfall is at Galway, about twelve miles distant, but as the sewage effluent is carried in an opposite direction, there is no risk of contamination of this oyster bed.

MR. LENEHAN'S LAYING, TYRONE BAY.—GALWAY RURAL DISTRICT.

(Map No. 13.)

This oyster laying is situate on the northern shore close to the junction of the Claren and Kilcolgan Rivers in Tyrone Bay. It is about one acre in extent, and is exposed at low water. It is used for storing oysters pending sale, Mr. Lenehan being a large dealer, who purchases oysters from neighbouring owners of beds and from fishermen. The oysters remain on the bed for periods varying from one week to a year. About 80,000 oysters are laid annually on the bed and taken up. Mr. Lenehan informed me that he disposes of about 200,000 oysters annually, which are sent from Oranmore Railway Station, about five miles distant, to Dublin merchants, packed with seaweed, in barrels and boxes. The oysters are sent direct from the bed or place where they are purchased, and only those are laid on his own oyster bed, which are not large enough for market, or for which he has no customers at the time. The bed is clean and the bottom gravelly and rocky. There is no licence for the bed.

Possible Sources of Contamination.

The only matter passing into the rivers is surface drainage from a few cottages and small houses at Stradbally, Clarenbridge, and at the weir. This would not affect the oysters so as to contaminate them, as the distance is over one mile from the bed.

MR. NEILAN'S OYSTER LAYINGS.—GALWAY RURAL DISTRICT. (Map No. 13.)

These layings adjoin Mr. Lenehan's, and are situate on the estuary of the Kilcolgan River, close to its junction with the Claren River. The bed is about one acre in extent close to the foreshore, and is partially exposed at low water. Mr. Neilan deals in oysters, and uses the bed principally for keeping oysters pending sale. A considerable trade is done, Mr. Neilan disposing of about 200,000 oysters during the season, which he purchases from the local fishermen and owners of private beds, and lays on his own bed pending sale. His principal customers are the owners of Dublin restaurants. The oysters are packed with seaweed in boxes or barrels, and forwarded by rail from Oranmore Railway Station. The bed is licensed. The bottom is a gravelly sand with slight admixture of mud, and is clean. The same observation as regards pollution apply in the case of this oyster bed as in that of Mr. Lenehan's previously referred to.

TYRONE OYSTER BED.

GALWAY RURAL DISTRICT. (Map No. 13.)

This oyster bed is owned jointly by Mr. R. K. St. George and Mrs. A. Browne, and is situated in the estuary of the Kilcolman River to the south of the public oyster fishery in Tyrone Bay. It occupies a narrow strip below low water mark on the shore from a point opposite Tyrone House for about

one mile to a point opposite Killeenaran village. The ground is a hard, gravelly one, with a mixture of sand and mud brought down by the river, and is clean except in patches where sea-grass and some weeds grow. The bed is held in fee simple, and is not licensed. Oysters are raised chiefly from spat, which is usually very abundant. 6,000 oysters were laid on this bed in December last—the first layings for the past twenty years—and were taken from the public bed adjoining. Four boats are employed dredging on this bed from 1st September to 1st December, when the dredging begins on the public beds. Dredging operations are, however, discontinued on this bed when the price of oysters becomes greatly increased. About 40,000 oysters are taken from the bed annually, and bought by Mr. Lenehan, a local dealer, and by Ms. Neilan, who forwards them direct to Dublin customers by rail packed with seaweed in boxes and barrels. (The Dublin customers are Hynes', Dolphin, and Burlington Restaurants.) The quality of the oysters is said to be excellent both as regards condition, size, and flavour. The same observation as regards pollution apply to this bed as to the public bed adjoining. There is, in my opinion, no pollution.

LICENSED OYSTER BED No. 115.—GORT RURAL DISTRICT. (Map No. 13.)

This oyster bed is owned by Mr. J. St. George (southern part) and Miss St. George, Tyrone House (northern part). It extends from Birr Island, northern boundary, to Pollagh Quay, southern boundary, occupying an area of 810 acres, including Brandy Harbour, the greater part of Rincarna Bay, and a strip of the sea about a quarter of a mile in breadth from low water mark as far as Pollagh Quay. The total length of the bed is about two miles. The northern portion of the bed from Mulroog Quay, about 600 acres in extent, has been sublet to Messrs. Hall and Rush. The bottom formation is a mixture of shingle, sand, and mud. The greater part of the bed is said to be clean, but has not been attended to for years. There is little or no stock on it, but it is intended to stock it during the coming season. No oysters have been taken from it for the past nine years. The bed does not appear to be subject to pollution from any source.

The southern portion of bed extends from Mulroog Quay to Pollagh Quay from low water mark for a distance of about a quarter of a mile seawards, and covers an area of about 200 acres, 80 of which are said to be stocked.

The bottom formation is rock gravel, with a mixture of sand and mud in places, and is clean. Oysters are raised principally from spat. Portion of the bed was stocked last year with oysters from Tralee Bay public bed and from adjoining public bed in Tyrone Bay, 125,000 oysters having been laid down to grow and fatten, for which purposes the bed is said to be well adapted. The oysters remain on the bed for periods varying from one to two years until they are fit for market, when they are taken direct from the bed, packed with seaweed in boxes, and forwarded by rail to customers in Dublin, chiefly the principal restaurants. Two boats are employed dredging the bed from 1st September to 30th April; the number of oysters taken is about 160,000 annually.

Possible Sources of Contamination.

I consider this bed is free from risk of contamination by sewage. The nearest sewer outfall is at village of Kinvara, three miles distant, the population of which is about 200, and nothing but storm and slop water is discharged from the sewer.

ISLAND EDDY LICENSED OYSTER BED (No. 170).—GORT RURAL DISTRICT.

(Map No. 13.)

This oyster bed is at present the property of the Atlantic Fishery Company, and covers an area of 502 acres 3 roods and 3 perches, extending from the north-eastern part of Eddy Island around the east and south of the island to a point about half a mile to the east of Eddy Point. It approaches to low water mark on the shore, and extends into Doorus Strait for about

half a mile from the shore, occupying the north-eastern part of it to within half a mile of Mulroog Quay, and extending along the eastern and northern shores of Eddy Island from low water mark outwards for about one quarter of a mile. The bottom formation is rocky and gravelly in places, and sandy, with mixture of mud in other parts. Oysters are raised principally from spat, of which the fall is said to be considerable. 150,000 oysters from Tyrone Bay public oyster fishery were laid down on the bed in 1901, but none since. The oysters laid remain for periods varying from six months to one year on the bed before being taken up and sent to market. Oysters are said to grow and fatten well on this bed. It is not stocked at present. During the season 1901, two boats were employed dredging for oysters, when about 90,000 were taken and sent to London Market packed with seaweed in boxes. I understand that it is intended to stock this bed during the coming season.

Possible Sources of Contamination

The nearest sewer outfall is at Kinvara village, a distance of four miles from the nearest point of the bed. I do not consider it probable that the bed could be contaminated from this or any other source.

MR. MANNIX'S OYSTER LAYINGS.—LOUGH MUCKINISH.

BALLYVAGHAN RURAL DISTRICT. (Map No. 13.)

Mr. Mannix, of Limerick, is the owner of four small oyster beds and leases nine other small beds, in Lough Muckinish. The beds are on the eastern shore of the Lough, extending from low water mark for distances varying from forty to eighty yards into Lough. The area covered by all of the beds is about ten acres. The beds are not licensed, but a licence has been applied for. The bottom formation is coral, old shells, and sand, with mixture of mud and pearls, and is clean. These beds are used for laying down oysters to grow and fatten. During the season 1901, 105,000 oysters from public beds in Galway Bay were laid, and during the past season 37,000 oysters from Tralee and Crushena public beds and from Cashel Bay oyster bed. The oysters remain on the beds for varying periods, generally from one to three years. Five persons are employed picking oysters at low water, and about 40,000 are picked annually from 1st September to 30th April. Consignments of oysters are sent off bi-weekly during this period by car to Ardrahan Railway Station and thence by rail to Limerick, where they are disposed of by retail at Mr. Mannix's establishment. They are usually packed in boxes containing some hundreds, and on arrival at Limerick are stored in a special place provided for them at the rear of Mr. Mannix's shop, and are not kept for more than two or three days before being eaten. They are not exposed to any contamination whilst in store.

Possible Sources of Contamination.

There are no sewers discharging into Muckinish Lough or nearer than Ballyvaghan, which is about four miles distant and in another bay. Ballyvaghan is a small town having a population of about 400, and is not drained on the water carriage system. Galway town is twenty miles distant across the bay, the sewage from which could not affect these beds. I am confident these beds are not subject to pollution from any source.

BURREN FISHERIES COMPANY'S OYSTER LAYINGS.

BALLYVAGHAN RURAL DISTRICT. (Map No. 13.)

This oyster bed is situate in Lough Muckinish and covers an area of about 100 acres in the northern part of the Lough between Muckinish Island on the west and the Burren shore on the mainland to the east. The bed extends across the Lough between low water mark on either side, and is

about half a mile in length by a quarter of a mile in breadth. About 35 acres of the bed are stocked with oysters. Portion of the bed is licensed, and the remainder is held in fee. The fall of spat observed is small, and is carried out to sea by the strong current. The bed is used for laying down oysters for growing and fattening purposes, and is said to be well adapted for these ends. The bottom formation is a coarse coral sand mixed with debris of shell overlying a marly foundation, and is kept clean and free from weeds, &c. During the past year oysters were laid down on the bed as follows:—From Tralee Bay, 250,000; Crushena Bed, 20,000; Tyrone Public Bed, 100,000; Carlingford Public Bed, 20,000; and from Arcachon and Auray (Brittany), 70,000. The oysters remain on the bed for varying periods, from one month to three years, according to circumstances. When fit for market they are picked at low water off the bed and conveyed to the packing house on the beach, where they are sorted and carefully packed with seaweed in baskets and boxes and forwarded direct almost daily by car to Ardrahan Railway Station, and thence to Dublin and other parts of the country, and to London. (The principal customers are Hynes' Restaurant, Dame-street, Dublin; Powell and Mooney, Dublin; M'Cabe, South City Markets, Dublin; and about 160 private customers in London and provinces.)

The handling and packing of the oysters from this bed is carried out on the most approved principles, the packing house being conveniently situated and fully provided with all requisite appliances. The annual output of oysters is about 160,000. Mr. Shaw is in charge of the bed, and has a staff of eight men employed. The oysters are of excellent quality, commonly known as Red Bank, and command a good price.

Possible Sources of Contamination.

The nearest sewer outfall is at Ballyvaghan, which is five miles distant from the bed and in another bay. The population of Ballyvaghan is about 400. The effluent from the sewer consists of slop and storm water, which is practically harmless, and in any event could not affect this oyster bed. Galway Urban District is twenty miles distant at the other side of Galway Bay. I consider this oyster bed is quite free from risk of contamination by sewage or otherwise.

GALWAY BAY.

MUSSELS, COCKLES, AND PERIWINKLES.





Mussels.—Very few mussels are collected, and these are taken chiefly close to Galway Urban District. They are exported to the English market, principally Liverpool and Manchester. The total amount collected all around the coast of Galway Bay would amount to possibly about two tons weekly. Only those collected near Galway are subject to pollution.

Cockles.—About one ton is collected weekly on the strands around the bay, and are chiefly disposed of locally. I am informed that none are collected from localities subject to contamination.

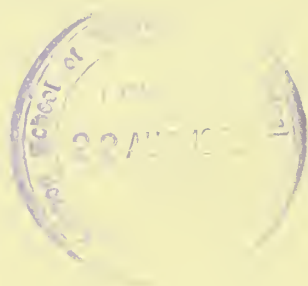
Periwinkles.—About one ton of periwinkles is collected per day on the shores of Galway Bay, and sent off per rail and steamer to the London, Liverpool, and Manchester markets. They are not taken from localities subject to contamination.

CASHEL AND KILKIERAN BAYS

MAP No 15

-  Oyster Beds
-  Sewer Outfalls
-  Oyster Pond
-  Surface Drainage Outfalls





KILKIERAN BAY NATURAL OYSTER BEDS, COUNTY GALWAY.

OUGHTERARD RURAL DISTRICT. (Map No. 15.)

Kilkieran Bay opens off the Atlantic Ocean on the southern coast of County Galway, and extends for a distance of about nine miles in an easterly direction from Ardmore Point to Inver Bridge. The bay is studded over with small islands, around and between which are to be found natural oyster beds. The coast is rocky and very sparsely populated.

The oyster beds are held under charter by Mr. Berridge, of Ballinahinch Castle, owner of the property in the district. The beds extend from a point about one mile to the east of Kilkieran Point, two miles from the mouth of the bay, for about five miles to within one mile of Inver Bridge, taking in portion of Garraig Sound and Camus Bay, and the whole of Roskeeda Bay.

The beds are very extensive, and, in places, approach to within a few yards of low water mark, but it is in the deeper parts of the bay in which the oysters are chiefly to be found. The oysters are entirely raised from spat, of which it is said there is an abundant fall. Ten boats and thirty men are employed in dredging operations from the 1st October till the 1st February. About 500,000 young oysters are taken up each season and transferred to Mr. Berridge's oyster beds in Birterbuy and Cashel Bays, which are worked in conjunction with these beds. None of the oysters are sold direct from these beds, as they are not in a fit state for market, the beds not possessing fattening qualities. The ground formation is a white coral sand overlying a dark-coloured peaty mud. The beds are for the most part clean and free from weeds, and have been regularly dredged for the past fifty years. The condition of the oysters is poor. They are black-bearded, probably from the quantity of peaty matter which finds its way into the bay from the surrounding bogs.

There is no sewage matter entering Kilkieran Bay, and no possibility of the beds being contaminated.

Periwinkles are collected around the shores of Kilkieran Bay and other bays opening off it, and are forwarded by rail and steamer to the London market.

BIRTERBUY AND CASHEL BAYS OYSTER BEDS, COUNTY GALWAY.

CLIFDEN RURAL DISTRICT. (Map No. 15.)

Birterbuy and Cashel Bays are situate on the southern coast of County Galway, opening off the Atlantic Ocean, and extend for a distance of about four miles in an easterly direction to the mouth of the Cashel River from Tawnrower Point at the entrance to the Atlantic. Cashel Bay is a continuation of Birterbuy Bay, and is studded with numerous small islands. The coast is rocky, and the population very sparse.

Mr. Berridge is the owner of the oyster beds, which are held under charter. The beds extend between Canore Point and Leigh Rock in the west for a distance of about two miles in a north-easterly direction to within about one mile of the eastern extremity of Cashel Bay and Leanagh Pool to the north-east of Gorm Island, occupying the eastern portion of Birterbuy Bay and the greater part of Cashel Bay.

These oyster beds are very extensive, and approach close to the shore, portions being exposed at low water, when oysters are picked by hand, and are dredged in deep water. The beds are used almost entirely for laying down oysters brought from the Kilkieran natural bed for the purpose of growing and fattening. From 300,000 to 500,000 oysters are laid down annually, and remain on the beds for periods varying from one to three years according as the oysters are found fit for market. Mr. John Hynes, Cashel, is the manager of the beds, and eight men are employed. The oysters are usually picked from the beds at low water of spring tides, and stored in a pond situate between high and low water mark at Lettercamp, where they are kept usually for a few days, or, in some cases, for a month, until disposed of. This pond is marked in blue on the map, and is very clean and free from any source of pollution. The oysters are sold chiefly to Mr. Lenehan, Stradbally, Oranmore; Mr. Neilan, Kilcolgan, Oranmore; Mr. Mannix, Limerick, and several local customers. About 200,000 oysters are disposed of annually during the season, from 1st September till 30th April. They are sent off by rail, packed in boxes or barrels, with seaweed, and, I am informed, are to a large extent disposed of by Messrs. Neilan and Lenihan to the proprietors of Dublin restaurants. The oysters are in fairly good condition, and average about $2\frac{1}{2}$ inches in diameter. The bottom formation is a coral sand overlying a yellowish clay, and is clean.

The only pollution entering the bays is the drainage from the Cashel Hotel and one or two private houses, which are nearly a mile distant from the nearest point of the beds, and would not be likely to affect the beds owing to the very small amount of drainage and the large expanse of water.

Periwinkles are collected around the shores of the bays and are forwarded by rail and steamer in bags to the London Market. There is no risk of pollution.

ESTUARY OF OWENGLIN RIVER.

CLIFDEN BAY, ARDBEAR BAY, AND MANNIN BAY.

ARDAGH OYSTER FISHERY, CLIFDEN RURAL DISTRICT. (Map No. 16.)

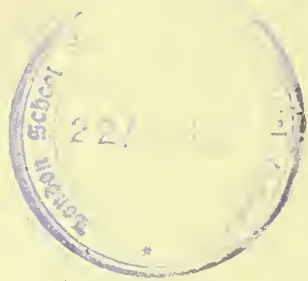
The estuary of the Owenglin River extends from Clifden to Turbot Island, a distance in all of about six miles. It is navigable for small coasting vessels as far as the quay, within half a mile of Clifden, and varies in breadth from 100 to 500 yards from its commencement at Clifden to Faul Point, where Ardbear Bay opens. From this point to Fahy Point it broadens out gradually to about one mile; opposite Fahy Point is the entrance to Mannin Bay, which presents a large expanse of water about four miles in length and two miles in breadth. In Ardbear and Mannin Bays there are three extensive licensed oyster beds (Nos. 15, 19, and 37). In the former bay is also one chartered oyster bed, and in Clifden Bay two chartered beds. Mr. Jackson, of Clifden, is the present owner of all of the oyster beds, which are worked in conjunction and known as the Ardagh Oyster Fishery, the licensed beds being used for breeding and growing purposes, and the chartered beds, particularly the one in Ardbear Bay, for fattening and preparation for market. The extent of the licensed beds is 674 acres 2 roods, and that of the chartered beds about 180 acres. Only 172 acres of the licensed beds are utilised at present, but almost the whole area of the chartered beds is under cultivation. Mr. Jackson informed me that the practice is to transfer the oysters, when they have attained a fair size, from the licensed beds to the chartered beds for fattening and growing, and that finally all oysters are laid on the Ardbear chartered bed for some months before being disposed of. The annual output of oysters is about 250,000. About two-thirds of the oysters are raised from spat on Mr. Jackson's beds, and the remaining third are layings got from the Tyrone Public Oyster Fishery, Galway Bay, and from the public bed, Tralee Bay. The oysters which are laid remain on



MAP No 16.

- Chartered Oyster Beds.
- Licensed Oyster Beds.
- Packing House.
- X — Sewer Outfalls
- + — Surface Drainage Outfall

70 Cables Sea Mile



the beds for periods varying from one to eighteen months before being sent to market. Five boats and nine men are employed on the beds dredging for oysters during the season from 1st September to 30th April. The oysters for market are dredged daily and placed on wire trays below low water mark on a shelving shore close to the packing house, which is situate at top of Ardbear Bay on the estuary of Ballinaboy Lough. . The oysters remain on trays for one or two days, and are then removed to the packing house, where they are packed in small wooden boxes, specially made for the purpose, in layers of seaweed, and forwarded direct by rail from Clifden Railway Station to customers, chiefly hotel proprietors and private individuals. (I was informed that His Majesty the King is supplied from these beds, the oysters being packed in double boxes with seaweed and sent off by Mail route.) Other customers are Midland Railway Company Hotels; London and North Western Railway Company Hotels; Glasgow and South Western Railway Company Hotels; Pavolney's Restaurant, Leeds; Army and Navy Stores, London; Spiers and Pond; Allen Line Steamship Co.; Exchange Station Hotel and Adelphi Hotel, Liverpool; J. Burke and Company, Kensington; the Guards' Messes, &c., &c.)

CHARTERED BEDS.

North Faul Chartered Oyster Bed is situate on the estuary of the Owen-glin River, Clifden Bay, between Faul Point and Doaghbeg Point, about one mile and a half from Clifden. It covers an area of about 40 acres, most of which is exposed at low water of spring tides, extending into Clifden Bay channel from ordinary low water mark. The ground formation is a white coral sand, with a slight admixture of mud, fairly firm, clean, and free from weeds. There is a fairly strong current passing over the bed. This bed is used for laying oysters for growing, and, to a certain extent, for fattening. No oysters are sent direct from this bed to market.

SOUTH FAUL CHARTERED OYSTER BED.

This oyster bed is situate in Ardbear Bay to the south of Faul Point, and occupies the northern portion of the entrance to the bay. The bed is bounded on the south by portions of licensed beds Nos. 19 and 37, which it adjoins at the junction of these two beds. It covers an area of about 60 acres, extending from the shore at low water mark into the centre of the bay: The ground formation is a fine sand with mixture of mud, the proportion of the mud being greater than in North Faul bed. This bed is clean and free from weeds, and is constantly dredged, which keeps it in a healthy state. It is from this bed that all oysters are sent for consumption. It is used entirely for fattening purposes. The oysters average about three inches in diameter, are in good condition, and about 30 per cent. have black fins or beards—a circumstance which is said to enhance the value of the oyster in some quarters.

CASTLE CHARTERED OYSTER BED.

This oyster bed is situate in Doonbeg Creek, opposite Clifden Castle, from which it derives its name. It is on the northern shore of Clifden Bay, and covers an area of about 80 acres, extending from low water mark into the bay. The ground formation is a grayish coral sand with a slight admixture of mud and fragments of shells. This bed is used for growing oysters, which are afterwards transferred to South Faul bed for fattening before being disposed of.

LICENSED OYSTER BED No. 15.

This oyster bed is situate at the extreme north-eastern extremity of Ardbear Bay, passing under Ardbear Bridge, and occupying the southern half of Ardbear Lough. Its extent is 90 acres 2 roods, only about 2 acres of which is availed of for oyster culture. It approaches close to low water mark along the shores of Ardbear Bay and Ardbear Lough. The portion situate in the Lough has not been cultivated for many years, and only a small portion in Ardbear Bay, adjoining licensed bed No. 37, is under cultivation. Oysters are transferred from this bed to North Faul bed for fattening, and then to South Faul bed for some time before sale. The ground formation consists of a mixture of sand, mud, and some gravel. The foreshore is covered with seaweed, and is rocky and shingly.

LICENSED OYSTER BED No. 19.

Portion of this oyster bed is situate around Drinagh Point in Clifden Bay, extending for a short distance into the entrance to Ardbear Bay, where it adjoins licensed bed No. 37. The other portion of the bed is in Mannin Creek, on the northern shore of Mannin Bay, extending into Lough Athola. The total area of the bed is 348 acres, only about 100 acres of which is under cultivation. It extends from low water into bays for distances varying from 100 to 800 yards. This bed is used chiefly for breeding purposes. A fair fall of spat is usual. No oysters are sent direct from this bed to the market.

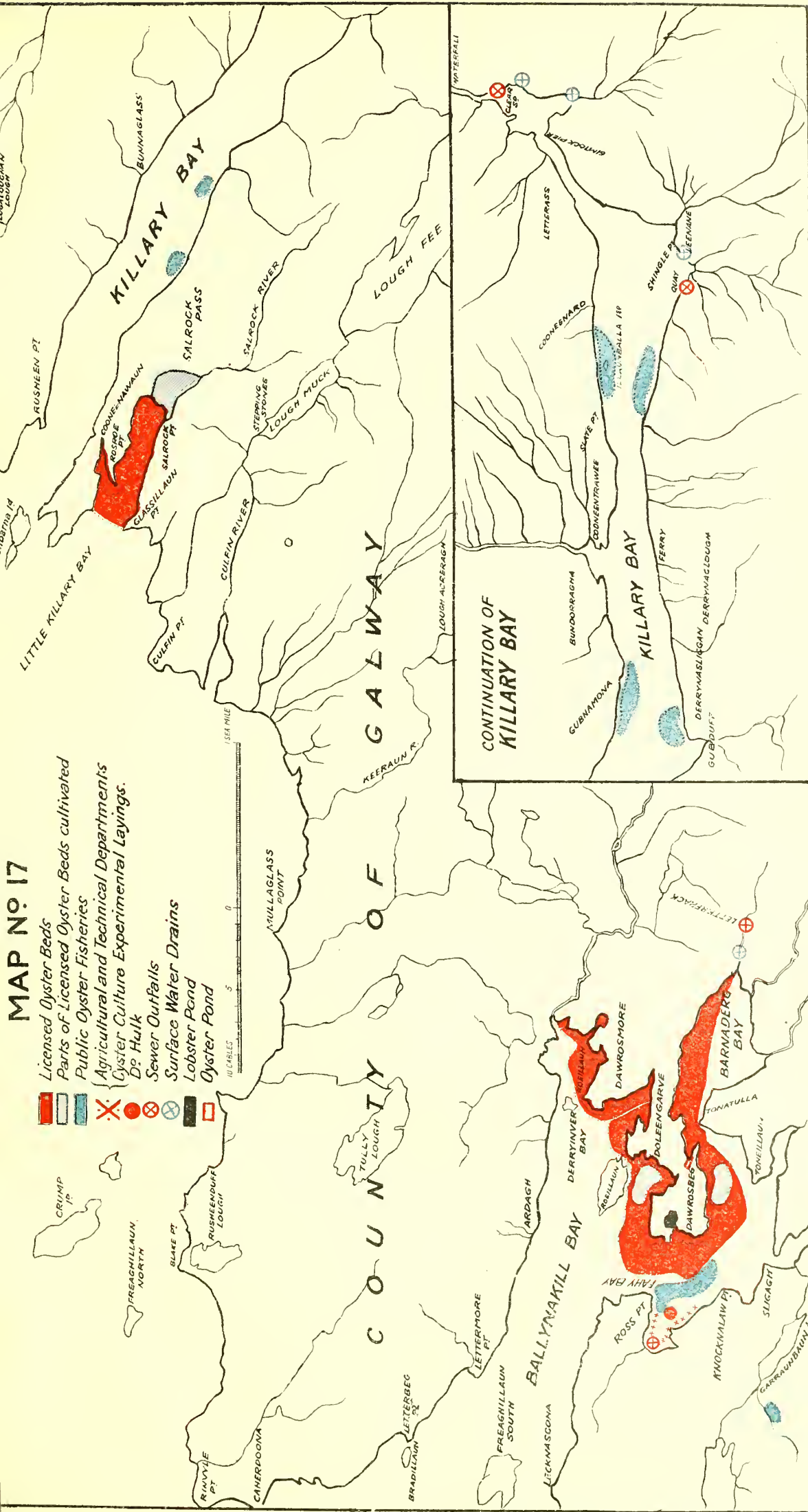
LICENSED OYSTER BED No. 37.

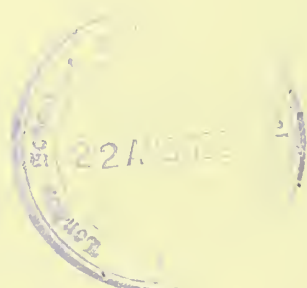
Portion of this oyster bed is situate on the southern side of Ardbear Bay, between licensed beds Nos. 19 and 15, the other portion occupying the eastern extremity of Mannin Creek in Mannin Bay, and adjoining the western portion of oyster bed No. 19. The area of bed is 236 acres, extending from low water mark into the bay. Only about a third of this bed is under cultivation, being used for breeding purposes. Last year a good fall of spat was observed. The oysters are transferred from this bed to fattening beds before sale.

Possible Sources of Contamination.

The only sewers discharging into the Owenglin River and its estuary are at Clifden, the population of which is 900. The main sewer discharges to the west of the town, the outfall being about one mile and a half from nearest point of the oyster beds (North Faul bed). I was informed that at most there are only about six water-closets connected with this sewer. The effluent is composed almost entirely of surface and slop water, with a very slight admixture of excrementitious matter, which is discharged in its crude state into the estuary. At the eastern end of the town, the Workhouse sewage is discharged into a settling tank, the overflow from which finds its way into a ditch, and eventually discharges into the Owenglin River, passing through a culvert under the railway. The sewage from the Convent and Industrial Schools, where the number of inmates is about 250, also finds its way to the river in the same manner. The effluent from these institutions is very small and entirely liquid in character, being conveyed in an open ditch for some hundreds of yards before entering the river. Having regard to the nature of the effluent, the large volume of water in the estuary, and the distance of the oyster beds from the outfalls, I consider the risk of contamination remote. In any event only the North Faul oyster bed and the Castle oyster bed could be in any way affected, being in the direct course of the estuary towards the open sea, and oysters are not sent direct from either of these beds for sale.

MAP No. 17





As regards Ardbear Bay, I could only hear of two sewers discharging direct into the bay, one from the Monastery into Ardbear Lough, at the opposite side from licensed bed No. 15. There are only four or five inmates of the Monastery, so that pollution from this source would, if it occurred at all, be infinitesimal. (It should be noted that the oyster bed in Ardbear Lough has not been worked for years.) There is also a house drain from Ardagh Shooting Lodge, discharging into Ballinaboy Lough, about one mile distant from the nearest point of the oyster bed. This I do not think could have any effect in causing pollution of the bed.

There are no sewers entering Mannin Bay and no contamination.

I am of opinion that the oyster beds in Ardbear and Mannin Bays are free from any risk of pollution, and that the possibility of contamination of the oyster beds in Clifden Bay is very remote.

BALLYNAKILL HARBOUR.—OYSTER FISHERIES.

Ballynakill Harbour opens off the Atlantic Ocean on the west coast of Galway County, and extends for a distance of about six miles from Rinivyle Point to the head of Barnaderg Bay; it is about three miles broad at its commencement, narrowing gradually to where it ends near the village of Letterfrack. It contains within its limits several small islands and inlets, also Fahy Bay, Barnaderg Bay, and Derryinver Bay. In these bays the oyster beds are situated.

FAHY BAY. (Map No. 17.)

CLIFDEN RURAL DISTRICT.—PUBLIC OYSTER BED.

This oyster bed is situate across the mouth of Fahy Bay, extending from shore to shore. In length it is about three quarters of a mile, and in breadth about one quarter. The bottom formation is mud with coral sand overlying, and is very weedy and covered with sea-grass. The depth of water over the bed at low tides varies from a few inches to eight feet. Oysters are occasionally picked up at low water of spring tides, and at other times one or two boats occasionally dredge, but very few oysters are to be obtained from the bed, the total output during the season scarcely exceeding 1,000. They are disposed of locally. The shells are large, but the fish are of poor quality. The oysters are raised from spat, which I presume does not settle on the bed owing to its weedy and neglected state. For many years past this bed has been very unproductive, and is likely to become entirely exhausted if something is not soon done to improve its condition. As regards the possibility of contamination, the nearest sewer outfall is at Letterfrack, close on four miles distant, at the head of Barnaderg Bay. The effluent from this sewer consists merely of the overflow from a cesspit in connection with the Industrial School, and flows in an open ditch for nearly half a mile before entering the bay. The inmates of the school number about 150. Pollution from this source is very improbable. There is also a hulk, the property of the Board of Agriculture and Technical Instruction, moored close to the bed. The crew of the hulk numbers four or five. I do not think it likely that the bed would be affected from this source either.

PRIVATE LAYINGS.

The Board of Agriculture and Technical Instruction have several experimental layings (marked thus *) along the foreshore of Fahy Bay. Mrs. Tullock, of Shaunbollard, has also a few oysters laid for private use at a place marked in red close to the experimental layings. I have been informed that the experiments have proved fairly successful, and that probably this area may before long be brought under cultivation by owners or occupiers of adjoining lands.

There are very few oysters on any of these beds except the one at Illaunballa Island. About 2,000 were dredged from this bed two years ago and disposed of to Captain Thompson for relaying on Little Killary Oyster Bed. Since then very few oysters have been taken, and the beds are practically derelict, as it does not pay to dredge them the oysters being so few. The bottom formation is a mixture of mud, gravel, sand, and peat, washed down from the surrounding mountains, and is very dirty and weedy. The cause of the dearth of oysters is said to be overdredging in former years, when there was a good fall of spat. Of late years very little spat has been observed. The oysters are over three inches in diameter and in good condition. Any taken are sold locally.

As regards pollution, there are only three sewers discharging into the bay—the Leenane Hotel sewer, and two sewers from private houses situated near the head of the bay. The nearest sewer to the oyster beds is the hotel sewer which is about half-a-mile distant. It is possible that pollution may occur in the case of the two nearest oyster beds in consequence of their proximity to this sewer, but I consider there is no risk of contamination as regards the other four beds.

LOBSTERS.

There is a very extensive lobster fishery at Ballynakill Bay, owned by the Atlantic Oyster Fishery Company. The lobsters are purchased by the Company from fishermen around the coast of Galway and Mayo, and stored in a pond about ten acres in extent at Dawrosbeg, Ballynakill Harbour. Several hundred persons are employed in collecting the lobsters, which are brought periodically by steamer to the fishery, and placed in the pond until sent to market. They are sent off alive packed with mountain heather in boxes chiefly to Messrs. Bennet and Coverly, London. About 150,000 lobsters are disposed of annually.

PERIWINKLES.

Periwinkles in small quantities are collected around the coast and sent to the London markets packed in bags. No other kind of shell-fish is collected.

COAST OF COUNTY OF MAYO.

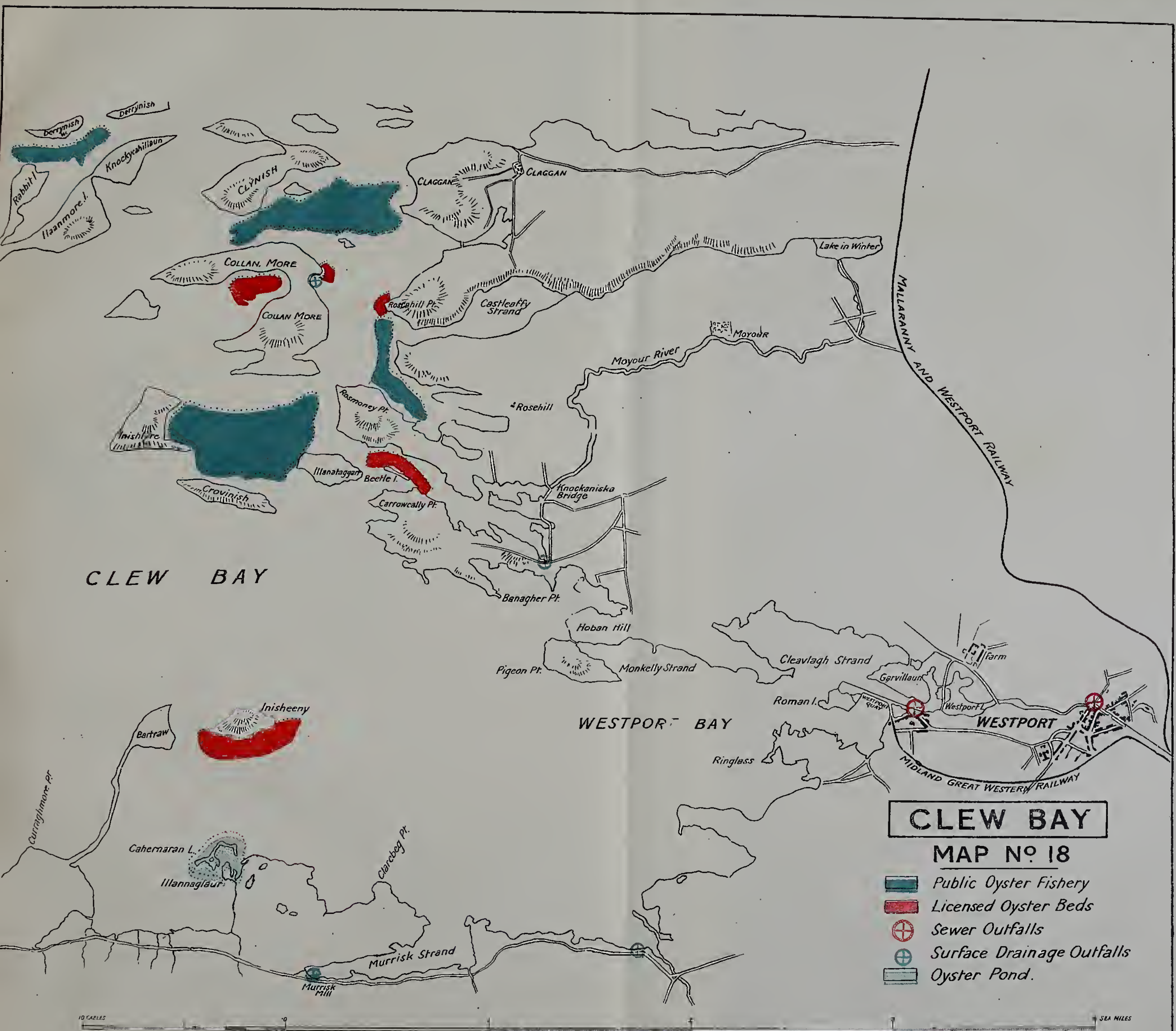
CLEW BAY OYSTER BEDS, &c.

WESTPORT RURAL DISTRICT. (Maps Nos. 18 and 19.)

Clew Bay is on the west coast of County Mayo, and opens off the Atlantic Ocean between Rornagh Head on the south and Achillbeg Island on the north, Clare Island being at its mouth, where the bay is about seven miles in breadth. The distance to its head is about fifteen miles. Within its limits are Westport and Newport Bays, which are studded over with numerous small islands, around and between which oyster beds are situated.





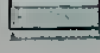
PUBLIC OYSTER FISHERIES.

There are several public oyster beds in Westport and Newport Bays. The principal one is situated at Inishlyre Roads, between the Islands of Inishlyre, Crovinish and Illanataggart, extending north to within a quarter of a mile of Rosmoney Point on the mainland, and close to the foreshore (at low water mark) of the three islands named. The area covered by the bed is about 200 acres. The bottom is composed of a mixture of sand, pebbles, and mud, and is very weedy in places and neglected. The oysters are raised from spat, of which the fall for many years past has been very poor. In former years this natural oyster bed was very productive. The falling off



CLEW BAY

MAP N° 18

-  Public Oyster Fishery
-  Licensed Oyster Beds
-  Sewer Outfalls
-  Surface Drainage Outfalls
-  Oyster Pond.



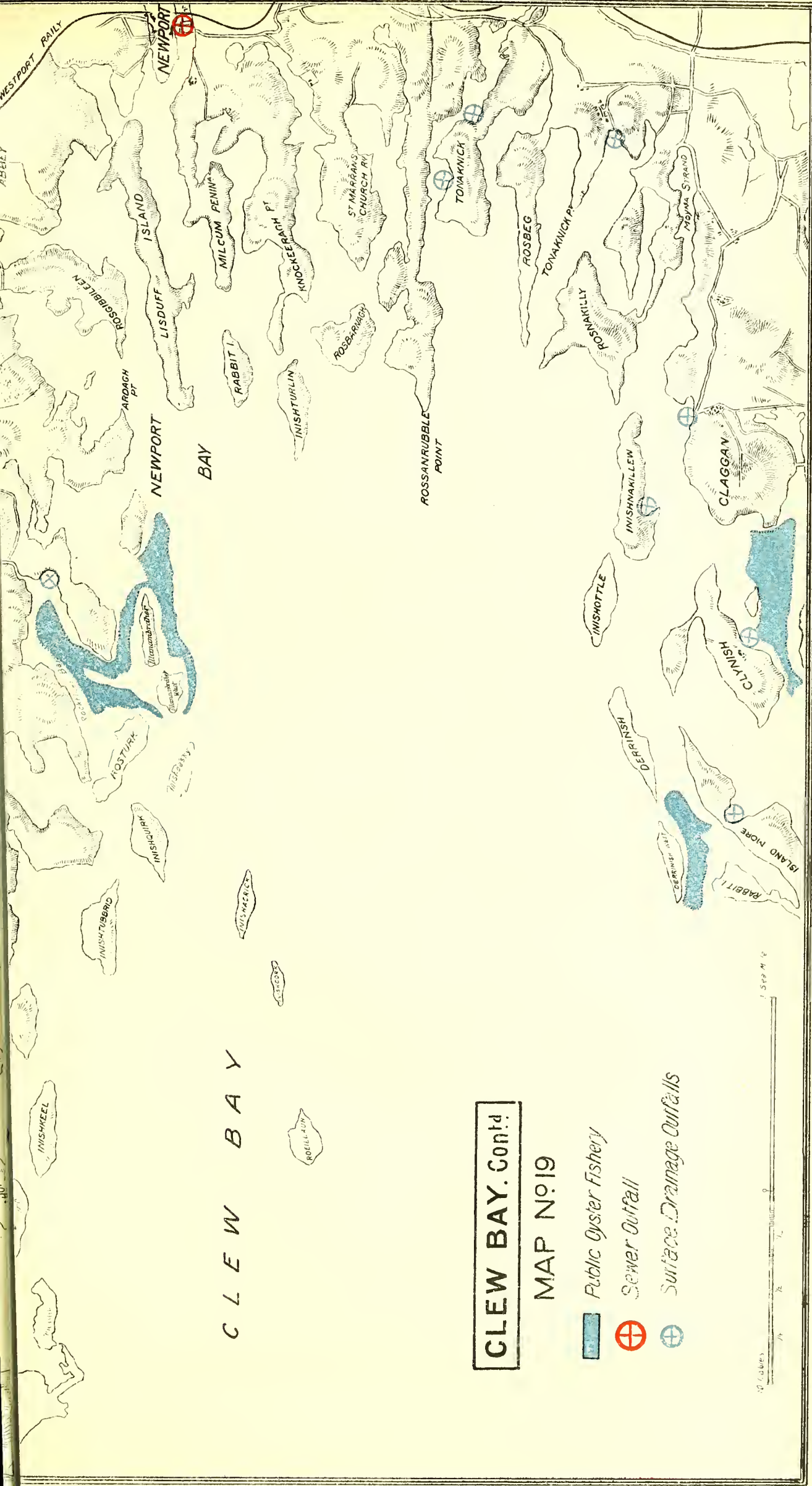
CLEW BAY. Cont'd.

MAP No. 19

Public Oyster Fishery

Sewer Outfall

Surface Drainage Outfalls





is attributed to over-dredging and neglect. The output for the past season did not exceed 2,000 oysters, which were sold locally or used for laying on other beds. Dredging operations are carried out on the public oyster bed from October to the end of April.

There is another small public oyster bed situate in the Creek to the east of Rosmoney Point, and extending close to Roscahill Point. This bed is in a neglected state and very few oysters are to be had from it.

In Newport Bay there are several public oyster fisheries. The principal ones are marked in blue on map No. 19. One, about 100 acres in extent, is situate in the Creek to the west of Claggan, extending along the southern shore of Clynish Island. This bed is in much the same state as the Inishlyre bed. Very few oysters are to be had from it.

Another bed of about 40 acres is situate in the channel to the south of Derrinish West Island, and is also in a neglected state and unproductive.

In Rockfleet Bay and around the Islands of Illanambraher, and in some places near the Islands of Inisdasky, Inisacrick, Iniscork, and Roeillaun, some few oysters are occasionally dredged. The yield is very small and scarcely worth taking into account. This state of affairs, I was informed, was brought about by overdredging and neglect, as in former years large quantities of oysters were procurable.

The total yield of oysters from all public beds in Clew Bay would not exceed 5,000 annually.

LICENSED OYSTER BEDS, WESTPORT BAY.

MURRISK OYSTER BED. (Licensed No. 8.)

This oyster bed, containing 64 acres 10 perches, is situate on the southern shore of Inisheeny Island, extending from high water mark for about 300 yards into the channel. Only about 4 acres of the bed near low water mark are under cultivation. The bottom is composed of limestone gravel, with a mixture of sand, debris of shells, and some mud, and is kept clean. In former years this bed was largely stocked with oysters from France, and from public oyster beds in Clew Bay, but for the past nine years no oysters have been laid. Any oysters now on the bed have been raised from spatting of old stock. Mr. Garvey, the owner, informed me that there was a fair stock of oysters on the bed at present, but that none had been sold for the past nine years. Next season it is his intention to market the oysters and re-stock the beds. There has been a fair fall of spat, but it is to a large extent carried away by a strong current. The bed is principally used for growing and fattening oysters, for which purposes it is said to be well adapted. In connection with this bed is a storage pond about two acres in extent, situate on the Island of Cahernaran, but it is not at present in use.

LICENSED OYSTER BED. (No. 141.)

Mr. F. Mulholland is the owner of this oyster bed, which has an area of 12 acres 1 rood and 20 perches. It is situate in the channel to north of Beetle Island, and between Rosmoney and Carrowcally. The bed is exposed at low water of spring tides, when oysters are picked by hand and laid close to low water mark so as to be available when required. There is some fall of spat on the bed, but it is chiefly used for laying oysters for growing and fattening. A few thousand oysters obtained from public beds in Clew Bay were laid on the bed during the past few years. The annual output averages about 4,000 oysters, which are sold locally and in Westport. The bed is kept very clean and free from weeds. The bottom formation is a mixture of sand, shells, and mud, and is firm.

Other licensed oyster beds in Clew Bay are No. 140, owned by Mr. Cawly; No. 144, owned by Mr. Russell; and No. 172, owned by Mr. Casey.

Mr. Cawly's bed is situate on the foreshore at the north-eastern extremity of Collan More Island, and has an area of 3 acres 2 roods and 2 perches. The bed has not been under cultivation for some time past.

Mr. Russell's bed is situate on the foreshore at Roscahill Point, and has an area of 4 acres 1 rood and 10 perches. The bed is not cultivated, and is in a weedy and neglected state.

Mr. Casey's bed is situate in the Creek on the western side of Collan More Island, and has an area of 44 acres and 37 perches. This bed is reported to be in a good state, but is not cultivated to any considerable extent. Some oysters are taken up and sold locally.

Periwinkles are the only other kind of shell-fish collected in Clew Bay. A very small trade is done with London, but I could not ascertain accurate particulars.

POLLUTION OF CLEW BAY.

The only sewers discharging into the bay are one at Westport town, one at Westport-quay, and one at Newport. The distance of the nearest sewer outfall to any of the oyster beds is five miles. Westport town, which has a population of 4,041, is drained into a stream flowing into Westport Lough, where all the solid portions of the sewage is deposited. The overflow from the Lough passes into the head of the bay near Westport-quay. The effluent has not the appearance of sewage, and was fairly clear at the time of my visit.

There are not more than a dozen water closets in connection with the sewer at Westport-quay.

Newport, with a population of 598, discharges its sewage into the river close to the town. The number of water-closets in connection with the sewer is small.

There are also surface drains and a few drains from private houses entering the bay at various points, but none in such close proximity as would be likely to affect the oyster beds. Having regard to all the circumstances, I consider there is no risk of contamination of any of these beds by sewage matter.

ACHILL SOUND, BELLACRAGHER BAY AND ACHILL ISLAND.

WESTPORT RURAL DISTRICT. (Map No. 20.)

ACHILL SOUND OYSTER BED.

Achill Sound extends from Achill Bridge, northern extremity, to Achillbeg Island, southern extremity, and separates the main land from Achill Island. It is about ten miles in length by a quarter of a mile to a mile in breadth. An oyster bed owned by Mr. Dickins occupies the eastern shore of the Sound on the mainland for nearly its whole distance to within a mile of Achill Bridge. The area of the bed is 317 acres 2 roods and 20 perches (licence No. 178). It extends from low water mark into the Sound for distances varying from 20 to 100 yards.

Only three patches of bed, marked in green on the map, and about twenty square yards in area, are cultivated. In 1899, 50,000 oysters from Arcachon, France, were laid on the bed, and in 1900, 100,000 from the same place were laid, many of which perished, but in all only about 600 were taken off the bed for use by Mr. Dickins' family. None were ever sold. The cause of failure of the bed is said to be due to the quantity of sand deposited on the bed by the strong current which runs through the Sound. Very little fall of spat was observed, and this is carried off by the current. The bottom formation consists of a mixture of sand and gravel with some mud in the places in which oysters are laid. Sea grass and sea weed grow in parts of the bed, but other parts are clean and free from weeds. No dredging has been done since 1901.

The only probable source of pollution entering the Sound is surface drainage from some house at the Sound Bridge, about four miles from the nearest part of the bed which is cultivated. There is also surface drainage

BLACKSOD AND BROADHAVEN BAYS.

PUBLIC OYSTER FISHERIES.

BELMULLET RURAL DISTRICT. (Map No. 21.)

BLACKSOD BAY.

Blacksod Bay opens off the Atlantic Ocean to the north of Achill Island, between Saddle Head, Achill Island, and Duvillannmore Island; and extends eastward and northward for a distance of about sixteen miles to Belmullet, where it is connected with Broadhaven Bay by a narrow channel. It is a very extensive bay, lying to the south and east of the Mullet, a narrow peninsula about eight miles in length. Within its limits are several smaller bays and inlets. The depth of water varies from twenty-eight fathoms to one-quarter fathom at low water.

There are several natural oyster beds at different parts of the bay, but for several years past these have not been productive. The principal beds are marked in blue on Map (No. 21). The largest bed is situate between Blacksod Quay and Ardelly Point, off the eastern shore of the Mullet. It approaches close to the shore in some places, and is several hundred acres in extent. The next largest bed is situate to the north-east of Claggan, in Trawmore Bay, and extends across the entrance of the bay from low water mark on the Claggan side to within a short distance of Toorglass Point. Its extent is about 80 acres. Between this bed and Belmullet there are in shallow water several smaller beds, varying from five to ten acres in extent. The distance from Belmullet to the nearest bed is nearly one mile. The ground formation is a mixture of sand and mud with debris of shells, the mud being in excess in places, rendering the bottom soft and unsuitable for oyster culture. The beds are for the most part very foul and covered with weeds, and have not been regularly dredged for years. Most of the oysters, which amount to a few thousands annually, are picked up at low water of spring tides, and are disposed of to local dealers, who re-sell them for laying on other beds. The oysters taken from the deeper beds are very coarse and of poor quality, and scarcely pay for the labour expended in dredging them. It is stated that there was a fair fall of spat observed last season. In former years these beds were very productive, but owing to overdredging and neglect in recent years, are now of little account as a source of supply.

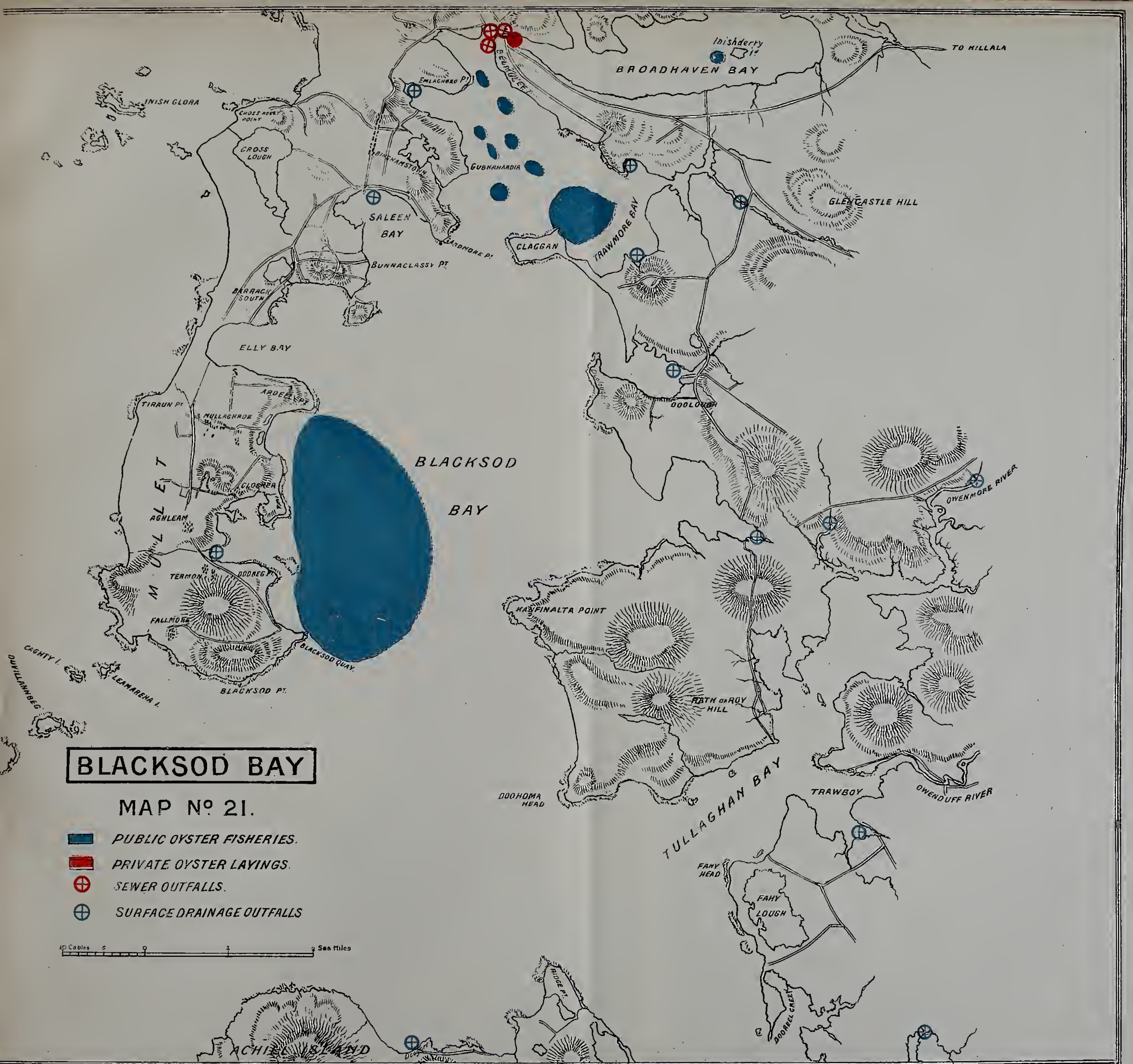
BROADHAVEN BAY.

There is a small public oyster bed to the west of Inishderry Island, and about three miles distant from Belmullet. It is scarcely worth taking into consideration in connection with the general question, as only a few hundred oysters are picked from it during the season at low tides. It is in a very neglected state and overgrown with weeds.

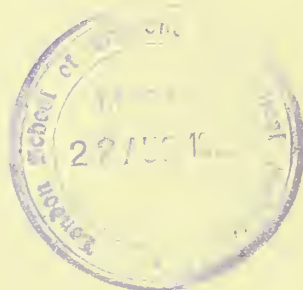
Within a couple of hundred yards of Belmullet town, on the Broadhaven Bay side, Mr. Campbell, a local dealer, stores oysters on the foreshore at low water mark. These oysters are purchased from the local fishermen and kept here pending sale. There are at present about 7,000 oysters laid at this place, which is within fifty yards of the outfall of a sewer. Mr. Campbell informed me that none of these oysters is sold direct from the laying for eating, and that they are disposed of entirely for relaying on other beds for fattening.

Possible Sources of Contamination.

I consider that the laying kept by Mr. Campbell must be polluted to a very serious extent, being so close to the sewer outfall, and also that some of the smaller beds in Blacksod Bay, near Belmullet, may likewise be







subject to contamination by the effluent from the sewers discharging into the bay. The population of Belmullet is 652, and the number of water-closets in connection with the sewerage system is estimated at about twelve. There is no likelihood of pollution from the surface drains marked on the map.

PERIWINKLES.

Periwinkles are the only other kind of shell-fish collected around the bays and coast about Belmullet. About 200 tons are collected annually and sent by steamer, packed in bags, to the London and Liverpool Markets. Between three and four hundred people are engaged collecting these shell-fish, which are stored on the foreshore, not far from sewer outfalls, until quantities sufficient to send off to market have accumulated. The keeping of periwinkles in the vicinity of the sewer outfalls is a most dangerous practice, and should be discontinued. (Messrs. Hammond, Billingsgate; Carter and Farrell, Billingsgate; and Sanzen, Billingsgate, are the principal merchants to whom the periwinkles are sent.)

KILLALA BAY OYSTER BED.

KILLALA RURAL DISTRICT. (Map No. 22.)

Killala Bay is an inlet of the Atlantic Ocean, on the northern coast of County Mayo, on the estuary of the River Moy, between Kilcummin Head, County Mayo, and Jenadorn Point, County Sligo. The bay is about eight miles broad at its entrance, gradually narrowing as it approaches Ballina. Bartragh Island lies across the bay opposite the town of Killala, and between the island and mainland is Moyne Pool, in which is situate an oyster bed, the property of Colonel Knox Gore. This oyster bed covers an area of 375 acres, occupying the southern half of pool, between Moyne Abbey ruins, and extending to within one mile of Killala. Only about 20 acres, marked green on map, are cultivated at present. The bed was licensed in 1897, and since then oysters from Portugal, Brittany, and from Public Oyster Fishery, Galway Bay, have been laid down, a few only of which have been taken up for private consumption, none having been sold. The portion of the bed cultivated contains about ten feet of water at low tides, so that dredging operations are necessary to obtain oysters and to clean away weeds, &c. Three persons are employed at this work. The bottom formation is a mixture of sand, gravel, and mud, overlying marl, and is firm and clean. The bed is suitable for growing and fattening oysters. Very little fall of spat has been observed. Colonel Knox Gore proposed stocking the bed during the coming season with young brood from Arcachon.

Possible Sources of Contamination.

The only sewers discharging into Moyne Pool are at the town of Killala, which is distant one mile and a half from the portion of the oyster bed under cultivation. The effluent from these sewers would, in the natural course, pass out to sea through the inlet to the west of Bartragh Island. The population of Killala is 510, and I am informed there are only six water-closets in connection with the system of sewers, the effluent being almost entirely surface and slop water. This could only reach the bed on incoming tides, and in a very diluted form, if at all. Ballina is some seven miles further up Killala Bay, and except at high water there is no communication east of Bartragh Island between Moyne Pool and Killala Bay. I am of opinion that, as regards this oyster bed, there is little risk of pollution.

No other form of shell-fish is collected in Killala Bay.

COAST OF COUNTY OF SLIGO.

SLIGO BAY. (Map No. 23.)

SLIGO RURAL DISTRICT AND DROMORE WEST RURAL DISTRICT.

Sligo Bay is a very extensive expanse of water opening off the Atlantic Ocean between Aughris Head on the south, and Dooneeragh Point on the north, the distance between these points being about five miles. The bay extends for a distance of about twelve miles to its head at Sligo, and has within its limits Ballysodare Bay, Sligo Harbour, Drumcliffe Bay, and Brown Bay. Inside Coney Island the bay narrows into a channel about 500 yards wide at low water. The channel is navigable as far as Sligo for vessels of about 500 tonnage. There are regular weekly cross-channel services of steamers between Sligo and Glasgow and Liverpool. There are also smaller coasting vessels plying regularly between Sligo and Ballina, Belmullet, Westport, &c. As will be seen on reference to the map, all vessels bound for Sligo must pass close to some of the oyster beds (Mr. Baker's and Mr. Kempt's).

ESTUARY OF BALLYSDARE RIVER.

This bay opens off the southern side of Sligo Bay, at Portecurry Point, and extends for a distance of about seven miles to its head at Ballysodare village. The entrance is narrow, but the bay widens out to a breadth of about two miles for the greater part of its extent. It is studded over with sand banks, between which are narrow channels, in some places of considerable depth, and in which the currents are very strong. Around the shores of the bay are several oyster beds. Mussels and cockles are also collected in considerable quantities.

OYSTER BEDS.

MR. VERNON COCHRANE'S Licensed Oyster Bed (No. 164)—DROMORE WEST RURAL DISTRICT.

This oyster bed is situate on the western shore of Ballysodare Bay, opposite the townland of Ballinlig, and about one mile from the mouth of the bay. The bed has an area of 41 acres 1 rood, and extends from low water mark for about 200 yards into the bay. Only about 5 acres are under cultivation. Eight years ago 200,000 oysters from France and the North Sea were laid down on the bed, but many of these oysters perished from one cause or another. Mr. Cochrane believes the bed was too shallow for the North Sea oysters. About 50,000 of these oysters were taken off the bed and disposed of to a local dealer about six years ago, and others have been sold since. There was a fair fall of spat the first year after the oysters were laid, but very little afterwards. The bed, as also the other oyster beds in Ballysodare Bay, is well suited for fattening oysters, for which they are laid, and also for growing. The oysters are of excellent quality. The bottom formation consists of sand, with a slight admixture of mud and debris of shells, and is firm and clean generally, but there are some weeds where the bed is not cultivated. The strong current flowing in the channel close to the bed has the effect of keeping it clean, although the bed has not been dredged for the past five years. Mr. Cochrane states that it is his intention to stock the bed next season.

This oyster bed seems to be free from suspicion of contamination.

MR. CRICHTON'S Licensed Oyster Bed (No. 169).—DROMORE WEST RURAL DISTRICT.

This oyster bed immediately adjoins Mr. Cochrane's on the south-eastern side, and extends along the foreshore to the border of south channel for a distance of about one mile, where it joins Mr. Verschoyle's bed. The extent of the bed is 100 acres 3 roods and 30 perches, only about 5 acres of which



**SLIGO
AND
BALLYSODARE
HARBOURS.**

MAP No. 23.

- Licensed Oyster Beds.
- Mussel Beds.
- Cockle Strand.
- Oyster Ponds.
- Oyster Rings.
- Oyster Parks.
- Sewer Outfalls.
- Surface Drainage Outfalls.



is stocked with about 16,000 oysters, obtained from Galway Bay public fishery. The bed is exposed at low water of spring tide, when oysters are picked by hand and the bed cleaned. 6,000 oysters were taken off the bed last season and disposed of to local people. One man is employed on the bed. The ground formation is a hard sand, with a little mud and shells mixed with it. The bed is used for fattening and growing purposes. Some spat which was observed was carried off by strong currents.

The oysters are taken direct from the bed and forwarded to customers, packed in boxes.

There is, apparently, no pollution of this bed, except surface drainage entering the River Arra at Ballysodare and Collooney villages, and possibly from two small streams, one within 500 yards of the bed and the other about half a mile distant.

Mr. VERSCHOYLE'S Licensed Oyster Beds (Nos. 59, 101, and 121).—DROMORE
WEST RURAL DISTRICT.

These beds adjoin Mr. Crichton's on the south-east, and occupy the Creek to the north of Derwich Island, extending into Ballysodare Bay for a distance of 300 to 400 yards. The total area of the three licensed beds which adjoin one another is 181 acres 2 roods and 20 perches, and is exposed at low water of spring tides. There are also four large artificial ponds in Tanrego Demesne which have been used for breeding oysters for stocking the beds, but for some years past the fall of spat has been small, and last season 20,000 oysters from the public fishery, Galway Bay, were laid on the bed. Nos. 59 and 101 licensed beds are partially stocked with oysters. No. 121 licensed bed is not stocked and is now used as a mussel bed. (Marked in blue on map.)

There is a very small stock of oysters—about 30,000—on Nos. 59 and 101 beds. During the past season 6,300 oysters were taken off the beds, picked by hand at low water, and sent weekly in small consignments, packed in small bags, to a dealer in Sligo.

The ground formation is a firm, hard sand, with mixture of bluish mud and shells, and is clean. Two men are employed on the beds. The cultivation of oysters on these beds has been neglected of late years, but Mr. Verschoyle informed me that it is intended to clean out the ponds and re-start the industry during the coming season.

The observations made above as regards the possible pollution of Mr. Crichton's oyster bed apply also to these beds.

Licensed Oyster Bed (No. 86).—(Late Colonel COOPER'S).—SLIGO RURAL
DISTRICT.

This bed is 190 acres in extent, and is situate on the eastern shore of Ballysodare Bay, opposite the townland of Carrowcrin, four miles distant from Ballysodare village. The bed extends from low water mark for about 300 yards into the bay. Only four acres are under cultivation, being used entirely for laying oysters for fattening purposes. During the season of 1901, 150,000 American oysters from East River were laid on the bed, and last season 30,000 were laid. These oysters arrive packed in barrels, each barrel containing about 1,000 oysters, and are laid on the bed close to low water mark, where they remain for about one year. Many of the oysters perish, probably in consequence of the lengthened period (from fifteen to twenty days) they are in transit from America. During the past season 50,000 were disposed of, principally to Messrs. Kelsall, Liverpool. Some are sent to Dublin, Sligo, Galway, Roscommon, Longford, &c. They are sent off packed with seaweed in boxes direct from the bed by rail and steamer from Sligo.

The ground formation is similar to that of other beds in Ballysodare Bay, viz., sand, with mixture of mud and shells.

The bed is not subject to pollution, except, possibly, from a small stream entering the bay about half a mile to the east of the bed which conveys surface drainage and the drainage from a Creamery.

Mr. PHIBBS' Licensed Oyster Bed (No. 176).—SLIGO RURAL DISTRICT.

This oyster bed adjoins the late Colonel Cooper's oyster bed to the north, and has an area of 81 acres 1 rood and 2 perches on the foreshore opposite the townland of Lisheen, Ballysodare Bay. It extends to the brink of the channel, and is partially exposed at low water of spring tides. Near low water mark Mr. Phibbs has constructed twelve parcs, formed by covering loose stones with a thick layer of coarse gravel, on which the oysters are laid. Above low water mark are two rings, each formed by a circle of large stones, which are used for storing oysters until required. The natural bottom formation consists of sand with a mixture of mud and shells, and is firm and clean. Mr. Phibbs considered that this bottom did not suit the oysters so well as the artificial parcs. The cultivation of this bed was begun in 1898, when 8,000 oysters from an adjoining bed were laid down; in 1899, 5,000 oysters from Galway public bed were laid down; and in 1901, 6,000 from Mr. Baker's bed in Sligo Bay. Last January 4,800 oysters from Tralee Bay were laid down. Oysters remain on the bed for about one year before being taken up. The oysters are principally used for private consumption, the surplus stock only being disposed of to a local dealer in Sligo, to whom they are sent off direct from the bed packed in baskets as required.

The bed possesses good fattening properties, for which purpose it is almost entirely used. Very little fall of spat was observed. One man is constantly employed on the bed.

The only drainage in the vicinity of this bed comes from Mr. Phibbs' residence, about half a mile distant, and would not be likely to affect the oysters.

In conversation with Mr. Phibbs, he informed me of the practice adopted in France in forwarding oysters to market, which he considers much superior to that adopted in this country. In France the oysters are sent off from the beds packed with layers of seaweed, in small hampers, and on the top of each hamper is a heavy stone cut to fit the hamper with a ring in the centre. The weight on the top has the effect of keeping the oysters fresh and in good condition for about nine days, as the water is retained in the shells. Each hamper is labelled with the name of the locality from which oysters are sent, and the date of transmission.

Mr. VERNON COCHRANE'S Licensed Oyster Bed (No. 7).—SLIGO RURAL DISTRICT.

This bed is situate to the north of Mr. Phibbs' oyster bed, which it adjoins. It is not stocked with oysters, and has been used as a mussel bed for some years.

The only possible pollution is the drainage from Mr. Cochrane's house, about a quarter of a mile distant from the nearest point of the bed. This, I think, could scarcely affect the bed, as the opening of the sewer is to the seaward of the bed, and any sewage would be carried out to sea.

Messrs. BROWN and BROWN, Limited, Licensed Oyster Bed (No. 163).—SLIGO RURAL DISTRICT.

This oyster bed adjoins Mr. Cochrane's, which is situate to the south, on the eastern shore of Ballysodare Bay. Its area is 130 acres 2 roods and 24½ perches, extending from the foreshore for a distance of about 300 yards into the bay, opposite the townland of Cullenduff. About 14 acres only of the bed close to low water mark of ordinary tides are under cultivation. At spring tides the greater part of the bed is uncovered. The ground formation is sand, with a mixture of shells and mud, and is firm and clean where cultivated. Very little fall of spat was observed, and it is for the most part carried off by a strong current which passes in the channel close to the bed. The bed is used for laying oysters for growing and fattening. Last year 30,000 oysters from Tralee Bay were laid down, and in former years young brood from Arcachon (France) were laid down on the bed. No oysters were taken from the bed during the past season. In previous years a con-

siderable trade was done. The principal customers were:—Philbin, Liverpool, and Corless, Dublin. The oysters were taken direct from the bed and packed with seaweed in boxes and sent by steamer and rail from Sligo. The sewer from Mr. Cochrane's house enters the bay about half a mile to the east of the oyster bed, and might, possibly, be a source of contamination, but as the sewage is conveyed in a channel some distance from the bed this seems improbable.

MUSSELS.

On portion of the bed mussels are collected and sent packed in bags to Philbin, Liverpool. About 150 bags are annually sent off by steamer from Sligo.

Mr. ROWE's Licensed Oyster Bed (No. 102).—SLIGO RURAL DISTRICT.

This oyster bed adjoins Messrs. Browns' bed to the north, and is situate on the foreshore opposite the townland of Culleenamore, Ballysodare Bay. It has an area of 52 acres 2 roods and 10 perches, most of which is exposed at low water of spring tides, when oysters are picked by hand. The area of the bed under cultivation is about 20 acres, and is not well stocked at present. 100,000 oysters from Arcachon (France) were laid down on the bed some three years ago, but the laying did not prove a success—many oysters perishing owing to sand drifting on to the bed. Very little spat has been observed recently, but in former years the fall of spat is said to have been considerable. The bed is used now for layings and for fattening purposes. 5,000 oysters were taken from the bed during last season and disposed of to private customers. The oysters were packed with seaweed in small boxes and sent off by rail direct from the bed.

The bottom formation of the bed is a firm sand, with a little mixture of mud and shells.

The bed is apparently not subject to pollution.

BALLYSODARE BAY.

Possible Sources of Contamination.

The villages of Ballysodare and Collooney are drained into Ballysodare or Arra River at the head of the Bay of that name, about four miles distant from the nearest point of any of the oyster beds. The population of the village of Ballysodare is 234, and of Collooney about 500. There is a creamery in the latter village. There are no water-closets in connection with the sewer, which discharges surface and slop water only. A few private houses along the shores of the bay are drained into it, and also a small creamery which discharges into a stream about a quarter of a mile before its entrance into the bay; this stream enters the bay about half a mile to the east of the late Colonel Cooper's oyster bed. The sewer outfalls from Mr. Phibbs' and Mr. Cochrane's houses are the only ones near any of the oyster beds on the eastern shore of the bay. There are no sewers or drains discharging on the western shore of the bay. Having regard to the great expanse of water in Ballysodare Bay, and the slight amount of pollution entering it, I consider that there is little risk of contamination of the oyster beds.

MUSSELS.

BALLYSODARE BAY. (Map No. 23.)

Mussels are picked and dredged at the places marked in blue on the map. About thirty persons are engaged collecting them. The quantity collected annually between October and March would amount to nearly 20 tons, and are sent off weekly by steamer from Sligo to Philbin, Liverpool, packed in bags.

The same observation as regards possible pollution apply to the mussels as to the oyster beds. I consider there is little or no risk of contamination.

COCKLES.

BALLYSODARE BAY. (Map No. 23.)

Cockles are collected on Culleenamore Strand and on White Strand, at the entrance to Ballysodare Bay. About thirty persons are engaged collecting them from May till August; the quantity collected is about 300 bushels, which are disposed of locally. I do not consider that there is any appreciable risk of their being contaminated.

PERIWINKLES.

BALLYSODARE BAY.

About 30 tons of periwinkles are collected annually in the bay and sent off in bags by rail and steamer to the London, Liverpool, and Manchester markets. About fifty persons are engaged in gathering them around the foreshore. There appears to be no pollution.

SLIGO HARBOUR.—ESTUARY OF CARVOGUE RIVER.—LICENSED OYSTER BEDS
(Nos. 99 and 100.—SLIGO RURAL DISTRICT. (Map No. 23.)

Mr. Kempt is the owner of two licensed oyster beds, Nos. 99 and 100. These beds adjoin and extend along the foreshore close to the channel from Standalore Point, within a mile of the nearest sewer outfall at Sligo, to the Coast Guard Station at Rosses Point. The beds occupy a narrow strip below low water mark, and have a combined area of 130 acres. These beds, I was informed, have not been cultivated for the past ten years and are now practically derelict. There are very few, if any, oysters to be got off them. The bottom formation is a mixture of gravel, sand, and mud, and is foul and covered with weeds generally.

Possible Sources of Contamination.

The sewage of the town of Sligo (population, 10,870), is discharged in its crude state into the River Carvogue, which enters Sligo Harbour, about one mile from the nearest point of the oyster beds, and flows in the channel quite close to the beds. Sligo is drained on the water carriage system, and there are several sewer outfalls discharging a large volume of crude sewage matter. In addition there is the possibility of contamination of the beds from the shipping entering the harbour. I am of opinion that these oyster beds are subject to pollution to a very serious extent.

Mr. BAKER'S Licensed Oyster Bed (No. 135).

This oyster bed is situate around Oyster Island at the entrance to Sligo Harbour and opposite Rosses Point. It is 77 acres 1 rood and 30 perches in extent, only a quarter of which is under cultivation. The cultivated part is situate to the south of Oyster Island on the opposite side from the channel leading to Sligo, in which the shipping passes up and down, and the sewage effluent is conveyed.

The ground formation of the cultivated portion of the bed is sand, with some mud and shells overlying marl, and is hard and very clean. There are about 100,000 oysters on the bed at present fit for market, and probably half a million young brood. There is a fair fall of spat, but it is carried off the beds out to sea by a strong current.

The bed is used for laying oysters for growing and fattening, for which purposes it is very suitable. During the past season 100,000 oysters from Tralee Bay and Galway Bay Public Oyster Fisheries were laid on the bed. The laid oysters remain on the bed for one or two years before being taken up; they are then picked by hand at low water of spring tides

and deposited close to the ordinary low water mark, so as to be available when required for market. 100,000 oysters were taken from the bed during the past season and disposed of to dealers in London, Dublin, Sligo, Armagh, Londonderry, and to private customers in various parts of England and Ireland. The principal customers were Carlton Hotel, London; Wilton's Restaurant, London; McConnell, Londonderry; Watson and Son, Eden-quay, Dublin; Powell, Chatham-street, Dublin; Traynor, Armagh; and about 100 private customers. The oysters are sent off direct from the bed packed in bags of 500 to wholesale dealers in Ireland, and in barrels containing 600 to wholesale dealers in England, and through Parcels Post in small quantities, packed in cardboard boxes, to private customers. Twenty persons are employed on the bed during the season from 1st September till 30th April.

Possible Sources of Contamination.

The oyster bed is more than four miles from the Sligo sewer outfalls. At Rosses Point there are some drains discharging on the foreshore with which four water-closets are connected; these discharge on the opposite shore from the oyster bed, where there is always a very strong current carrying the effluent out to sea. I consider that any possible risk of contamination there might be would be caused by the effluent from the Sligo sewers.

MUSSELS.

About fifty tons of mussels are collected annually, from October to April, on the Middle Bank and Channels between Sligo and Rosses Point, within about two miles of the sewer outfalls at Sligo, and one mile from Rosses Point. The mussels are forwarded by rail and steamer to London, Liverpool, and Manchester markets. The same observations apply to these mussel beds as to Mr. Kempt's oyster beds adjoining. They are, in my opinion, subject to contamination.

COCKLES.

Cockles are gathered on the Dorrins and Cummeen Strands in Sligo Harbour from June till August; about 100 bags, each bag weighing 2 cwt., are collected, and sold locally. The cockles collected from the parts of Cummeen Strand nearest to Sligo would probably be subject to contamination by the effluent from sewers which are about two miles distant. The sewage passes in the channel to the north of the strands, but some portion of it might possibly be carried back on to the strands by the incoming tide.

PERIWINKLES.

About three hundred bags of periwinkles are collected all the year round around the shores of Sligo Harbour. Each bag weighs about 2½ cwt. The periwinkles are sent off direct by rail and steamer from Sligo to the London, Liverpool, and Manchester markets. The periwinkles gathered near the Sligo sewer outfalls and in the upper half of Sligo Harbour would, I consider, be liable to pollution from sewage effluents.

DRUMCLIFFE BAY. (Map No. 23.)

ESTUARY OF DRUMCLIFFE RIVER.—SLIGO RURAL DISTRICT.

OYSTERS.

Drumcliffe Bay opens off Sligo Bay, between Raghly Point and Dead-man's Point to the north of Coney Island, at the entrance to Sligo Harbour. The bay is three miles in breadth at its mouth, and extends inland for a distance of five miles to Drumcliffe village. At low water the greater part

of the bay becomes dry, exposing large stretches of sand banks. A narrow channel of varying depth extends the whole length of the bay to the estuary of Drumcliffe River. The situation of the channel is constantly changing owing to drifting sand, and is not navigable except for small coasting craft as far as Lisadill.

Sir Jocelyn Gore Booth, Bart., is the owner of two licensed oyster beds (which adjoin) on the northern shore of Drumcliffe Bay, extending from a point opposite Lissadill House across the mouth of Carney Bay and around Finned Point. The combined area of the beds is 235 acres 3 roods. The beds extend into Drumcliffe Channel from the foreshore, and are partially exposed at low water. The western bed, owing to drifting sands, has been practically abandoned of late; there are no oysters on it at present. A small portion of the eastern bed to the east of Finned Point has a small stock of oysters. Some six years ago 22,000 oysters from Galway Bay Public Fishery were laid down on this part of the bed, and four years ago 11,650 were taken up and disposed of; none were sold since then.

The bottom formation of the western bed is sand, and of the eastern bed a mixture of gravel, sand, and mud. The latter bed is weedy and neglected. Scarcely any spat has been seen. The beds have been used for laying oysters for fattening and growing, and are said to be well suited for these purposes. About twenty years ago these were very important oyster beds, and a very large trade was done in the London, Glasgow, and Liverpool markets, and also in Dublin and provincial towns.

Possible Sources of Contamination.

There are no sewers discharging into Drumcliffe Bay—only some surface drainage from the two small villages of Carney and Drumcliffe, but this could not affect the oyster beds, which are from one to two miles distant. There are no water-closets in either of the villages, and there is, I consider, no risk of pollution of the oyster beds.

PERIWINKLES.

About 30 tons of periwinkles are gathered around the shores of Drumcliffe Bay during the whole year. They are forwarded by rail and steamer to the Liverpool, Manchester, and London markets, packed in bags.

There is, as stated above, no risk of pollution in Drumcliffe Bay. No other form of shell-fish is collected in Drumcliffe Bay.

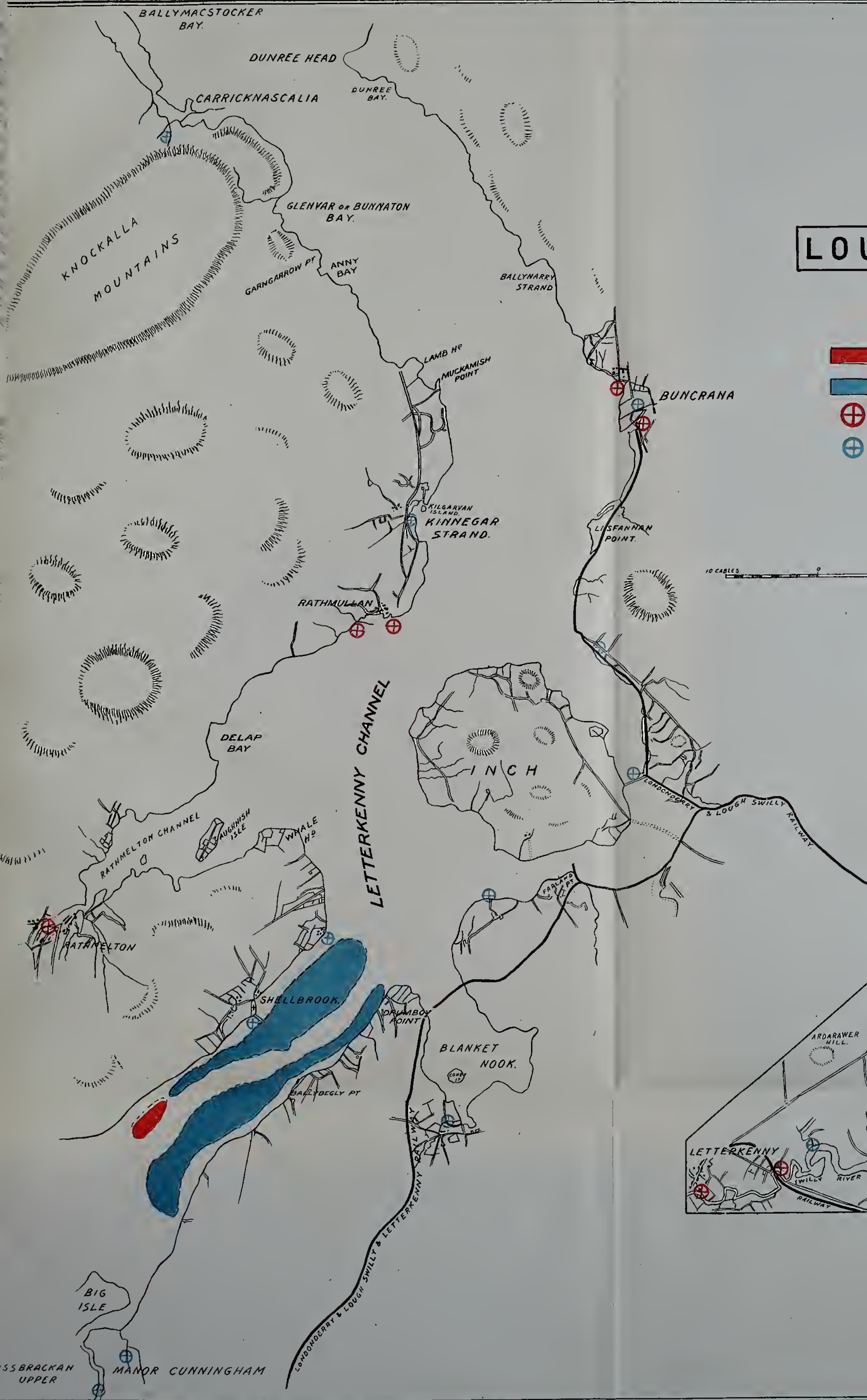
COAST OF COUNTY OF DONEGAL.

LOUGH SWILLY OYSTER FISHERIES, &c.

(Map No. 24.)

LONDONDERRY AND LETTERKENNY RURAL DISTRICTS.





Lough Swilly opens off the Atlantic Ocean on the Coast of Donegal, between Fahan Head and Dunaff Head, where it is about five miles in width, and extends inland for about thirty miles to its head near Letterkenny. It varies in width throughout its whole distance, from one to three miles, and contains within its limits many small bays and inlets. Several rivers of considerable dimensions flow into the Lough at various points, the principal of which is the River Swilly near Letterkenny, at the head of the Lough. The Lough is frequented by the largest warships, which anchor off Rathmullen, about half way up the Lough, and is navigable for small craft to within about one mile of Letterkenny.



LOUGH SWILLY.

MAP N° 24.

REFERENCES.

-  Oyster Bed (Private)
-  Public Oyster Fishery
-  Sewer Outfalls.
-  Surface Drainage Outfalls.





PUBLIC OYSTER FISHERY.

There are two natural oyster beds in Lough Swilly, one on the north side, between Ballygreen Point and Ardrummon, in the Letterkenny Rural District, and the other on the south side of the Lough, between Drumboy Point and Ballaghan. The beds are exposed at low water of spring tides, when oysters are picked by hand, and each extends for a distance of about three miles along the shore, from low water mark to the edge of Letterkenny channel. The bottom formation consists of a mixture of sand and mud, and is hard and firm in some places, but in others it is soft, covered with weeds, and foul. About twenty-five persons collect oysters when the tides are suitable and dispose of them to a local dealer (Mr. McGuinness), who sends them off in bags to merchants in Belfast and Liverpool by rail and steamer. Some are also sold to hawkers in Londonderry. I visited a hawker's residence in the latter place, and found that the oysters were stored in a yard in the rear of his dwelling-house. The yard was in a most filthy state, and there was a very foul piggery close to the place where the oysters are kept. Only a few hundred oysters are got at a time, and these are kept four or five days until disposed of. The total output of oysters from these beds would amount to about 20,000 annually. They are raised entirely from spat, which of late years has been diminishing in quantity.

Possible Sources of Contamination.

The nearest sewer outfalls are at Letterkenny, seven miles distant, Rathmelton, eight miles, Rathmullen, nine miles, and Buncrana, fifteen miles, from the nearest points of the beds. The population of Letterkenny is 2,320; there are about 160 water-closets connected with the system of sewers, which discharge the sewage in its crude state into the River Swilly, close to the town. The river is very winding and sluggish, with deep mud banks for some two or three miles below the town, and these circumstances would doubtless tend to the deposit of the solid portions of the effluent before reaching the Lough. Rathmelton is the second nearest town to the oyster beds, and has a population of 1,152. There are very few water-closets in the town. The sewers discharge into the tidal portions of the river close to the town; the effluent is conveyed in the channel which enters Lough Swilly some miles north of the beds, and passes out to sea without coming into contact with the beds. Rathmullen, which has a population of a little over 500, is drained directly into Lough Swilly. There are about twenty water-closets in the town. The sewage is discharged in its crude state, the distance of the outfalls from the oyster beds being about nine miles. The effluent is carried out to sea in an opposite direction from the beds. Rathmullen is the headquarters of the Guard ship, which is moored off the town about nine miles to the north of the oyster beds and nearer the mouth of the Lough.

Buncrana, which has a population of 1,316, is not provided with a system of sewerage. The better-class houses are drained into cesspits, which are regularly cleaned out. The overflow from some cesspits finds its way into Buncrana Bay, which is about fifteen miles to the north of the oyster beds, and nearer the entrance of Lough Swilly.

Having regard to all the circumstances, I am of opinion that there is no risk of the beds being polluted.

MR. MANSFIELD'S LICENSED OYSTER BED.

This oyster bed is situate on the northern shore of Lough Swilly, adjoining the public oyster bed to the west, opposite Ardrummon. The area of the bed is 37 acres 3 roods, and extends from ordinary low water mark to the edge of channel. The bed has not been cultivated for the past five years, and only passed into Mr. Mansfield's possession last year. About eight years ago a quarter of a million Dutch oysters were laid down on the bed, about half of which were taken up and disposed of. Last season four

barrels, each containing 700 oysters, were taken off the bed; three barrels were sent to Messrs. Mussen and Company, Liverpool, and one barrel to the Burren Oyster Fishery Company, County Clare. The oysters were taken direct from the bed and sent off packed with seaweed by rail and steamer.

There are still some oysters on the bed, but Mr. Mansfield intends stocking it fully during the coming season, and having the bed properly cleaned and looked after. There has been some fall of spat, which probably was not retained on the bed. Oysters are laid down for fattening principally. They are picked off the bed at low water of spring tides.

The ground formation is a mixture of sand and mud, and is fairly firm and clean in some places, but for the most part is weedy and neglected.

The same observations as regards pollution apply to this bed as to the public beds adjoining.

No other kind of shell-fish is taken from Lough Swilly.

COASTS OF COUNTIES OF DONEGAL AND LONDONDERRY.

LOUGH FOYLE OYSTER FISHERIES, &c. (Map No. 25.)

Lough Foyle opens off the Atlantic between the Counties of Donegal and Londonderry, and extends from its entrance at Macgilligan Point to Culmore Point, a distance of about fifteen miles, where it joins the River Foyle. It is about one mile broad at its entrance, gradually widening to seven miles opposite Newtown Limavady, becoming narrower up to Culmore Point, where it is about a quarter of a mile broad. From Culmore Point to Londonderry City, a distance of about eight miles, the River Foyle is about half a mile in breadth, and is tidal for some distance above Londonderry City.

PUBLIC OYSTER FISHERIES.

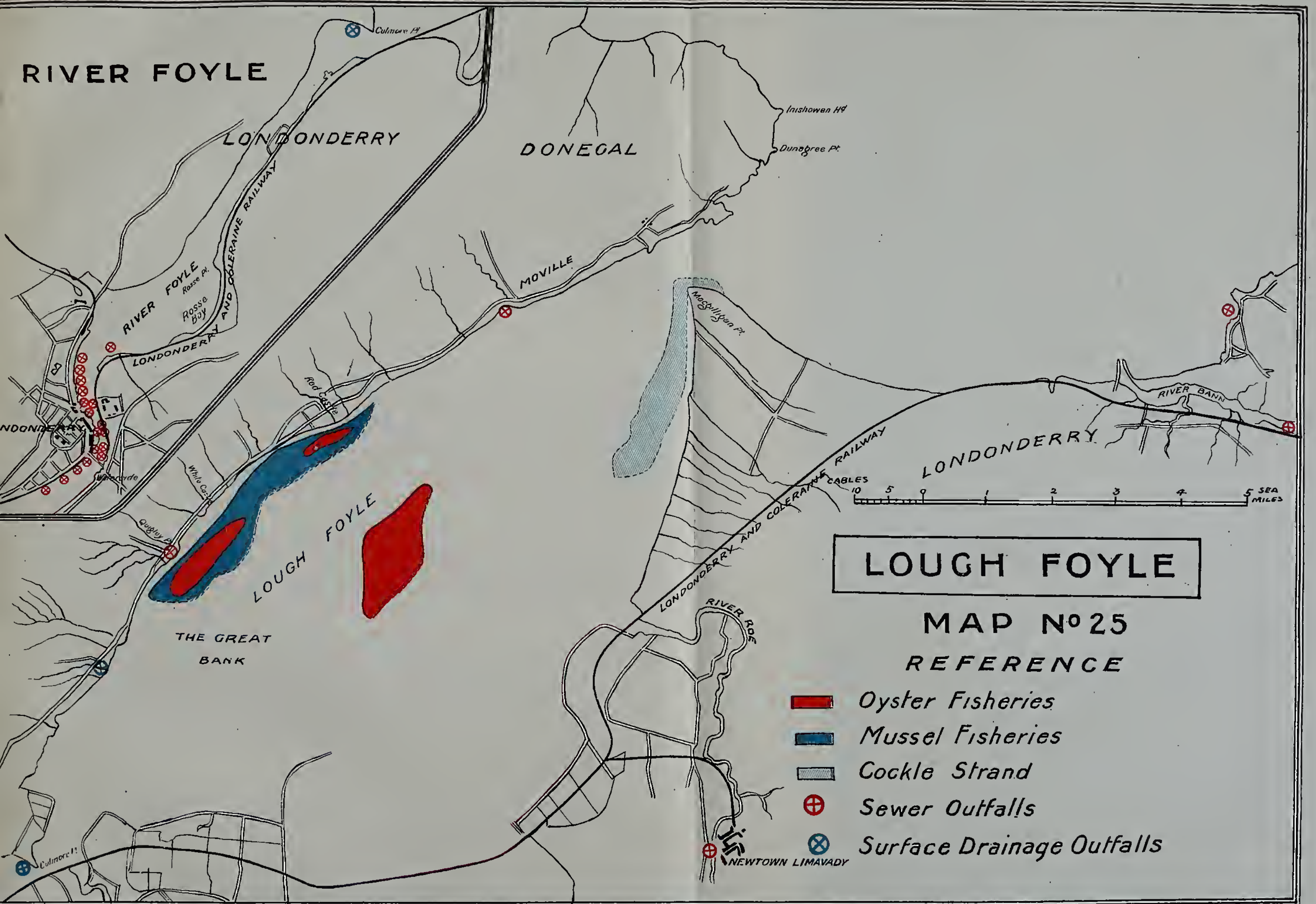
INISHOWEN RURAL DISTRICT.

There are three public oyster fisheries in Lough Foyle; two on the northern shore—one opposite Quigley Point, and the other opposite Red Castle—and the third about the centre of the Lough, opposite Newtown Limavady. The fishery opposite Quigley's Point extends for about a mile from a little below low water mark to a point opposite White Castle, and is about one mile in length by about a quarter of a mile broad. The fishery opposite Red Castle is situate in the gullet, and extends from below low water mark for a distance of about half a mile along the shore, and is about 200 yards in width. The fishery in the centre of the Lough is situate to the south of East Channel in Limavady Rural District, and is about one mile in length by three-quarters of a mile in breadth. The bottom formation of the beds is a mixture of gravel, sand, and mud, and is in places foul. The oysters are raised from spat, of which there has been a scanty fall for years past resulting in a scarcity of oysters. I was informed that the take of oysters from all three beds during the past season did not amount to more than 5,000. Three boats were employed occasionally dredging, but the takes were so small as to scarcely pay for the labour. The oysters are sold locally in Londonderry City, Limavady, and some are sent to Belfast, packed with seaweed in boxes, and despatched direct from the beds by rail. The oysters average over three inches in diameter and are of good condition.

Possible Sources of Contamination.

The chief pollution of the River Foyle is the sewage of Londonderry City, which has a population of 39,892, and is drained on the water carriage system. The sewage is discharged into the River Foyle in its crude state at several points in its course past the city. The nearest sewer outfall is at a distance of about ten miles from the oyster bed at Quigley's Point, which

RIVER FOYLE



LOUGH FOYLE

MAP N° 25

REFERENCE

- Oyster Fisheries
- Mussel Fisheries
- Cockle Strand
- Sewer Outfalls
- Surface Drainage Outfalls

is the nearest bed to Londonderry City, the other beds being about two miles further off. The depth of the river over a large part of its area is six fathoms at low water. Having regard to the number of miles of waterway intervening between the point at which the sewage is discharged into the River Foyle, and the great volume of water with which the sewage becomes mixed before arriving at the site of the oyster beds, it must, I consider, be inferred that there is little risk of contamination from this source. The sewage of the towns of Limavady and Moville also enter the Lough. The sewage of Limavady, which has a population of 2,692, is discharged into the River Roe, about twelve miles distant from the nearest point of the oyster beds, and passes out to sea through the channel about two miles to the south of the nearest oyster bed. There would, therefore, appear to be little risk of pollution of the beds from this source.

The sewage of Moville (population, 1,162), is discharged into Lough Foyle, about four miles to the seaward of the nearest oyster bed, and passes out to sea direct. There is a large expanse of water opposite Moville, the depth at low water being about eight fathoms. There would appear to be no risk of pollution from this source. Surface drainage is also discharged into the Lough at some places, the nearest being at Quigley Point. The oyster beds could not, I consider, be affected thereby.

I was, however, informed that sometimes the dredgings from the bed of the River Foyle are deposited in the vicinity of the oyster bed on the southern side of the Lough. This would, in my opinion, constitute a possible source of contamination of the bed.

MUSSELS.

Mussels are dredged and collected by hand on the northern shore of Lough Foyle in the vicinity of the oyster beds. Some are shipped to Scotland for use as bait, but the greater number are used by farmers for manuring their lands. About six boats are employed dredging for mussels from the beginning of March till the end of May.

I am of opinion that the mussels taken from this locality are not subject to pollution.

COCKLES.

Some cockles are collected on Magilligan Strand and disposed of in the neighbouring town. None are exported. I was unable to ascertain approximately the quantity collected, but it was said to be small.

There is apparently no pollution.

PERIWINKLES.

About twenty tons of periwinkles are collected annually around the shores of Lough Foyle. About 200 persons are engaged in gathering them when the tides suit. They are sent off in bags by rail and steamers to the London, Glasgow, and Liverpool Markets.

COASTS OF COUNTIES OF ANTRIM AND DOWN.

BELFAST LOUGH.

ESTUARY OF RIVER LAGAN (Map No. 26).

Belfast Lough is situate on the North-east Coast of Ireland, and opens off the North Channel, between Black Head, County Antrim, and the Cope-land Islands, off the Coast of County Down. It is about eight miles wide at its entrance, and extends for a distance of about sixteen miles to its head at Belfast, narrowing gradually to about two miles near Belfast. There are several towns and populous places situated along the shores of the

Lough, the principal of which are the City of Belfast, Carrickfergus, Bangor, and Holywood, and there are also the villages and residential districts of Groomsport, Crawfordsburn, Sydenham, Whitehouse, Greencastle, Whiteabbey, and Green Island, all of which are drained into the Lough.

PUBLIC OYSTER FISHERIES.

There are several natural oyster beds in different parts of Belfast Lough, the principal of which are situated, as marked in red on Map No. 26. About 400 yards off the northern shore of the Lough to the South-west of Black Head, where there are from seven to nine fathoms of water at low tide, there is an oyster bed about half a mile in length and a quarter of a mile in breadth. I was informed that very few oysters are now to be got on this bed, and, consequently, it is very seldom dredged. On the same shore is another natural oyster bed between Cloghan Point and Bonnybefore, about two miles to the west of Carrickfergus, and 500 yards from low water mark. The depth of water over the bed at low tide is from four to five fathoms. It is about two miles long and 500 yards wide.






On the southern shore of the Lough there are two natural oyster beds. One is situated to the west of Grey Point, about two miles from Bangor and a half mile from the shore, in six fathoms of water at low tide. The bed is about half a mile in length and the same distance in breadth. This bed is occasionally dredged, the yield of oysters during the season amounting to only a few hundreds. To the north-east of Groomsport Village, about half a mile from shore, is another natural oyster bed about the same extent as the Grey Point bed, and in a similar depth of water. The yield of oysters from this bed is also very small, being only a few hundred during the season. In the centre of the Lough there are several places where oysters are found, the nearest to Belfast being at No. 1 Lighthouse, about four miles distant from the main sewer outfall of the city. This bed is of small extent, and very few oysters are to be got from it—possibly two or three hundred during the season. There are about four fathoms of water over the bed at low tide. The bottom formation of the beds is a mixture of sand and mud, and is fairly firm and clean, which latter is mainly due to the strong current which sweeps over the beds. Two boats are engaged occasionally dredging for oysters on all of the beds when the state of the weather and the tide permits. The total output of oysters from all beds would amount to about 2,000 annually during the season from October to April. The oysters are disposed of locally and in Belfast, Bangor, and Carrickfergus. Some twelve years ago the output of oysters from Belfast Lough natural oyster beds was very considerable, about twenty boats being regularly employed in dredging operations during the season.

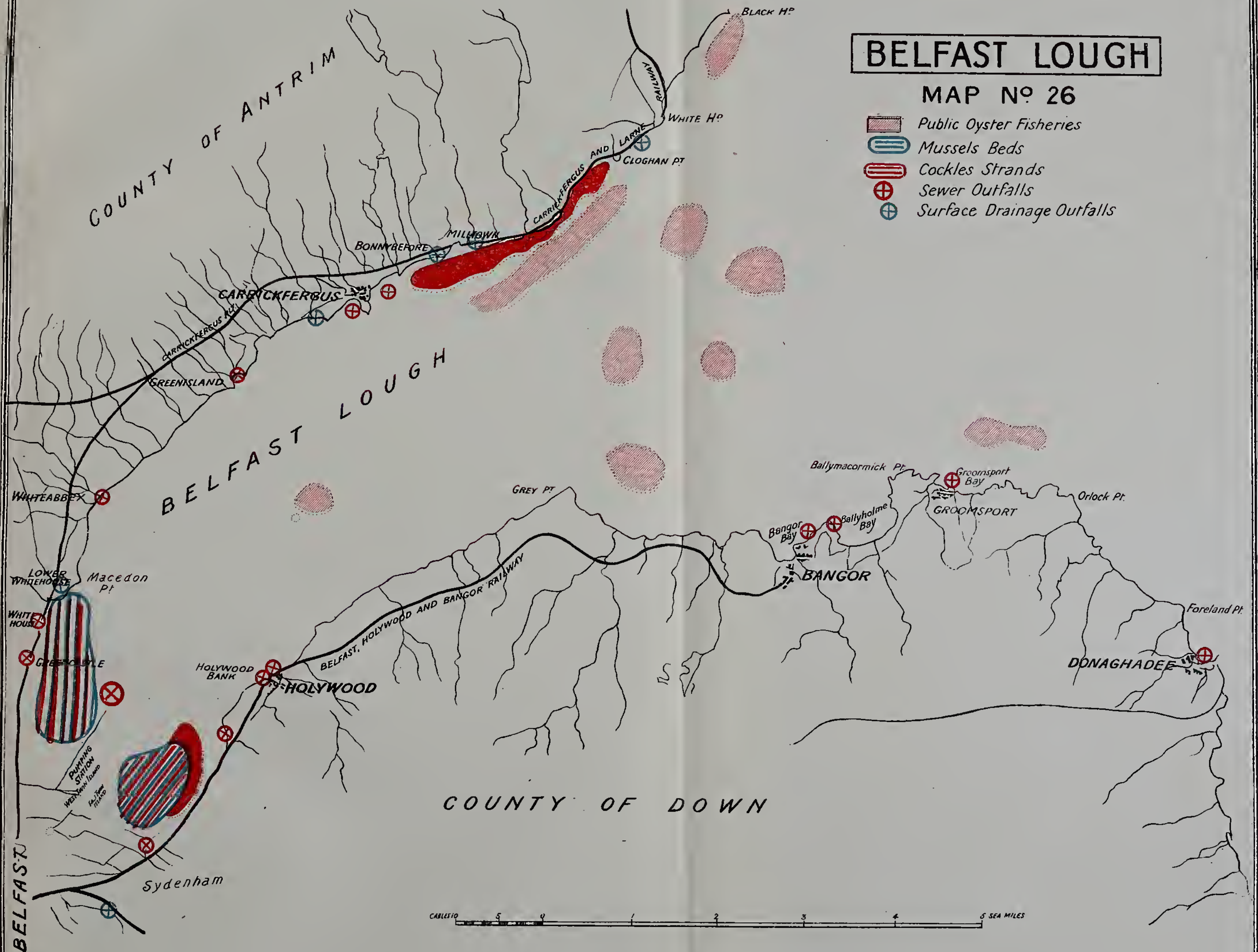
MUSSELS.

Mussels are collected in Belfast Lough along the foreshore at low water on the northern side, from Macedon Point, Lower Whitehouse, to within a short distance of the pumping station in connection with the sewerage system of Belfast and within fifty yards of the sewage outfall. On the southern side of the Lough mussels are collected at low water on the foreshore between Tillysburn, Sydenham, and East Twin Island. Mussels are collected all the year round, but chiefly from August to May. About sixty tons are exported weekly during these months to Aberdeen, Peterhead, Fraserburgh, and Berwick, to be used for bait for fishing purposes. Some are also sent to Liverpool and Manchester, and are used as food. Large quantities are also collected by the working classes in Belfast on holidays and at other times, and are eaten by them either in a raw state or cooked.

BELFAST LOUGH

MAP No 26

-  Public Oyster Fisheries
-  Mussels Beds
-  Cockles Strands
-  Sewer Outfalls
-  Surface Drainage Outfalls





COCKLES.

Cockles are collected at the same places as mussels and also along the strand to the north-east of Carrickfergus. Large quantities are taken all through the year and disposed of locally and in Belfast, Bangor, Carrickfergus, Holywood, etc., etc. The working people of Belfast collect cockles for their own use, which they eat either raw or cooked.

PERIWINKLES.

Periwinkles are collected all around the foreshore of Belfast Lough, but, I was informed, are not exported, being used locally as food after being cooked.

POLLUTION OF BELFAST LOUGH.

The chief pollution of Belfast Lough is the sewage of Belfast City, the population of which at last census was 349,480. Almost the whole volume of the sewage is discharged in its crude state into the Lough below low water mark opposite Greencastle. About one-twentieth part of the sewage is treated in bacteria beds as an experiment; the results, I am informed, have proved so satisfactory that it is proposed to deal with the whole volume of sewage in a similar manner. The amount of crude sewage discharged into the Lough at Belfast is enormous, and discolours the water of the Lough for a very considerable distance from the outfall. The sewage is, however, only discharged on first half of ebb tides, when there is a great expanse of water at the outfall and in the Lough. Notwithstanding this, however, I consider that the shell-fish in the vicinity of the outfall, particularly the mussel and cockle strands opposite Greencastle on the northern side, and Tillysburn on the southern side of the Lough, are subject to gross contamination, and, to a lesser extent, the oyster beds in the Lough over which the sewage effluent passes, but in a varying degree, according to the distance from the outfall, and the consequent dilution of the effluent.

Carrickfergus, having a population of 4,208, is drained to a considerable extent on the water carriage system. The crude sewage is discharged by two principal outfalls opposite the town at low water mark direct into Belfast Lough, within about half a mile of the cockle strand and one mile of the nearest point of an oyster bed, both of which I consider must to some extent be affected thereby.

Bangor, with a normal population of 5,903, discharges its sewage by two principal outfalls, to the east of the town, directly into the Lough without any previous treatment. The town is drained almost entirely on the water carriage system; the consequent pollution must be very considerable, and would be likely to affect the oyster beds in the vicinity.

Holywood, with a population of about 4,000, is drained directly into the Lough by three principal sewer outfalls. The town is drained on the water carriage system almost entirely, and the sewage is discharged in its crude state, the effect of which would be to contaminate shell-fish in the near neighbourhood of the outfalls. There are also numbers of private houses drained direct into the Lough all along its shores, and also many surface drains entering it at various points.

The number of vessels cleared from the Port of Belfast in 1901 was 8,132, having an aggregate tonnage of 1,271,515. The pollution from this source must be very considerable.

Enteric fever has been very prevalent in Belfast for several years past, and it seems probable that the consumption of shell-fish, which is very general, particularly amongst the working classes, may have to some extent been accountable.

I may mention here that when visiting the mussel and cockle strands in Belfast Lough, I saw several people gathering these shell-fish only a few hundred yards from the sewer outfalls, and, on questioning some of them,

found they were workmen from the shipbuilding yards who were taking a holiday. They informed me that it was a common practice for the workmen to collect shell-fish in the same locality and to bring them home for their families to eat. The shell-fish are generally eaten cooked, but sometimes in the raw state. On further inquiry I was informed that several members of the workmen's families who had partaken of the shell-fish had subsequently developed enteric fever, but that whether the disease was caused by the shell-fish or not was not ascertained. However, I consider the facts are worth mentioning.

The Medical Superintendent Officer of Health of Belfast City (Dr. Whitaker) informed me in 1898—the year of the greatest prevalence of enteric fever in the city—that there were 5,136 cases of the disease notified, and that last year the number was 1,044. Several of the cases were attributed to the eating of shell-fish collected on the shores of Belfast Lough, but he could not inform me of the number of such cases.

RETAIL SHELL-FISH DEALERS, BELFAST.

When visiting Belfast for the purpose of this inquiry, I went to the places of business of most of the dealers in shell-fish in order to ascertain particulars as to the storage and treatment of shell-fish. I found that native oysters were got from Whitstable, Whitehaven, Grimsby, Cleethorpes; also from Cork Harbour, Carlingford, and Clontarf. Re-laid American oysters were got from Carlingford and Clontarf, and American oysters direct from Liverpool. The oysters from across channel arrived packed in barrels, in which they were usually kept until disposed of, which would sometimes be for a period of eight days. The barrels were usually kept in the shops—just as they arrived—without water or any packing. The native oysters arrived in boxes packed, generally with seaweed. Consignments were in some instances got daily and in others bi-weekly or tri-weekly. In one instance the oysters were stored in concrete tanks in the back part of the shop, and fresh water and salt added daily; in others they were stored in cool, clean cellars, and never kept for longer than three days. As far as I could judge the oysters were not subject to contamination in any of the shops.

Cockles were the only other kind of shell-fish sold, and were procured daily from Dundrum Bay, Strangford Lough, Dundalk Bay, Lough Foyle, and Donaghadee. They were kept in buckets in the shops, and never for longer than a day.









STRANGFORD LOUGH.

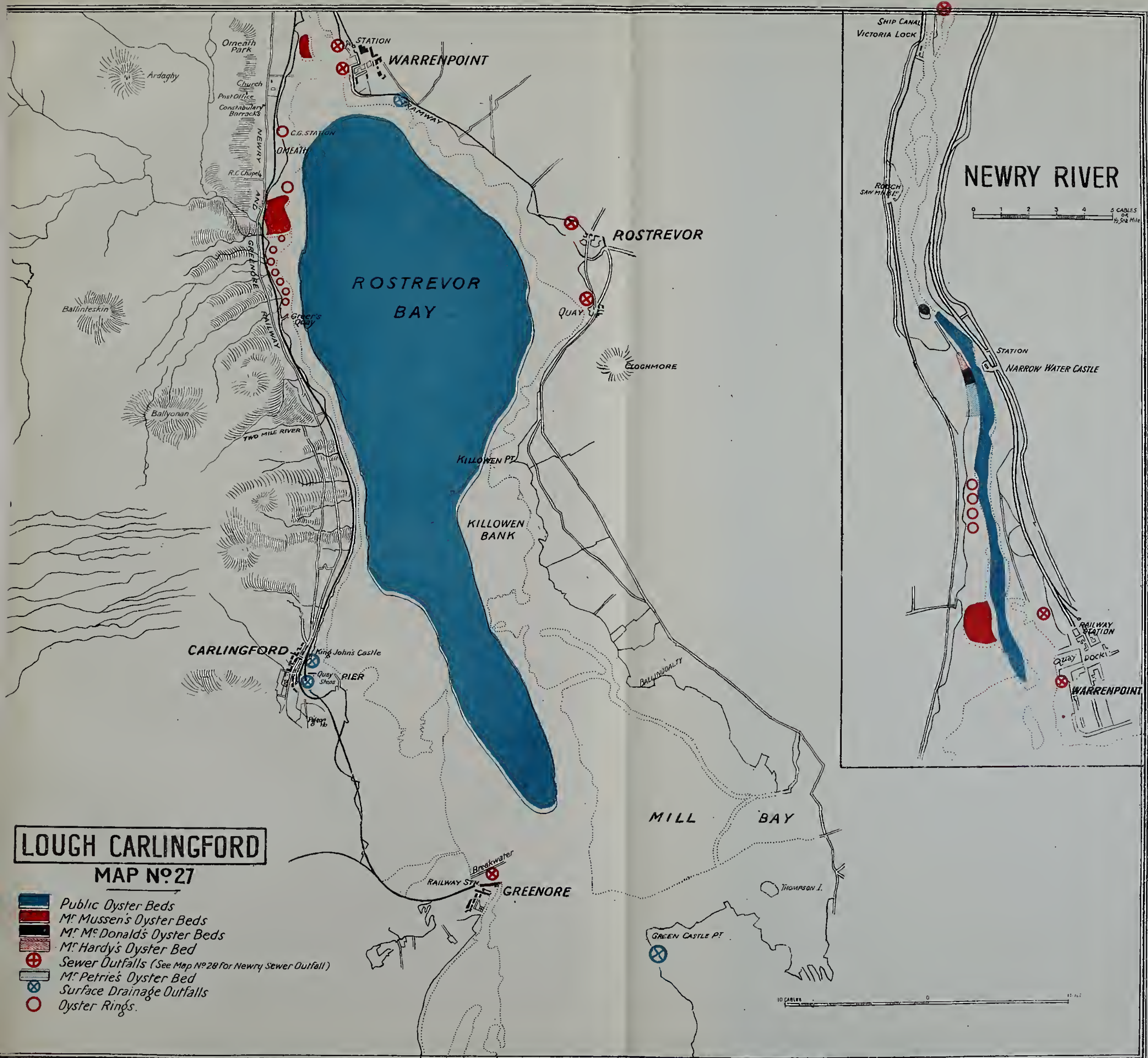
NEWTOWNARDS RURAL DISTRICT.

Strangford Lough is an inlet of the Irish Sea on the East Coast of County Down, and extends for a distance of about 20 miles to its head at Newtownards.

Cockles and periwinkles are collected at low water on the shores of the Lough from January till the end of July. The cockles are picked off the strand about three miles from Newtownards, and periwinkles nearer the entrance of the Lough. The quantity of cockles collected would amount to about thirty bags during the season. These are disposed of locally, and to dealers in Belfast and Bangor. About three tons of periwinkles are collected annually, and sent in bags by rail and steamer to Liverpool and Glasgow. About fifty tons of periwinkles are collected around the coast from Belfast Lough to Carlingford Lough during the year, and sent to London, Liverpool, and Glasgow markets. Several towns drain into Strangford Lough, the principal being Newtownards, having a population of 9,110. This town is not drained on the water carriage system, and the volume of sewage entering the Lough is, comparatively speaking, small. The great expanse of water in Strangford Lough would dilute the effluent to such an extent as to render it in all probability harmless before reaching the strand where the cockles are collected.

LOUGH CARLINGFORD MAP N°27

-  Public Oyster Beds
-  Mr. Mussen's Oyster Beds
-  Mr. McDonald's Oyster Beds
-  Mr. Hardy's Oyster Bed
-  Sewer Outfalls (See Map N°28 for Newry Sewer Outfall)
-  Mr. Petrie's Oyster Bed
-  Surface Drainage Outfalls
-  Oyster Rings.



10 CABLES 0 10 CABLES



COASTS OF COUNTIES OF DOWN AND LOUTH.

DUNDRUM BAY.

DOWNPATRICK RURAL DISTRICT.

This bay is situate on the coast of County Down, to the south of the entrance to Strangford Lough.

Cockles are collected on the strand of Dundrum Creek from January till August. About one bag is picked daily and disposed of in Belfast and locally. The only pollution entering the bay is the sewage from Dundrum, the population of which is 503. There are about six water-closets in the village discharging into the sewer. The cockle strand is situate about a mile inland from the point of discharge of the sewer, and would not, in my opinion, be affected thereby.

CARLINGFORD LOUGH AND NEWRY RIVER. (Map No. 27).

Carlingford Lough opens off the Irish Sea, between Cranfield Point on County Down Coast and Ballagan Point on the Coast of County Louth. It is about ten miles in length, and varies in breadth from three miles at its entrance to one mile opposite Greenore, its narrowest point. Further inland the Lough again widens out. The depth of water varies from one-half to fourteen fathoms at low water.

The Lough is situate in the Rural Districts of Kilkeel, Newry, and Dundalk, and abuts on the Urban District of Warrenpoint, opposite to which town is the mouth of the Newry River.

NATURAL OYSTER BEDS.

Nearly the whole of Carlingford Lough, from about one mile north of Greenore to Warrenpoint, is a natural oyster bed. The bed extends to within a few hundred yards of the shore at low water around the Lough. See map No. 27.) There is a second public oyster fishery in the bed of Newry River, extending from a point about a quarter of a mile to the west of Narrow Water, on the Newry side to the Icar Rock, opposite Warrenpoint. Oysters are dredged for on these beds from 1st November till 15th January. About eighty boats are employed in the operations. Each boat has a crew of three men. The total output of oysters for last season was about 1,500,000. The oysters are for the most part sold to local dealers and owners of layings in the Lough and Newry River for re-laying. Some are deposited on rings situate on the foreshore near low water mark, opposite the holdings of the fishermen. The object of putting the oysters on the rings is to keep them until higher prices are obtainable. They are not kept on rings for more than a few weeks at most. The rings are simply small patches of the foreshore, a few yards in circumference, surrounded by large stones to prevent the oysters being washed away in rough weather. A large proportion of the oysters are dredged from the bed in Newry River. The bottom is clean and firm, and composed of a mixture of sand and mud. The Carlingford Lough bed is muddy and foul in places, particularly that portion opposite and nearest to Rostrevor, where very few oysters are to be had. In other parts the bottom is cleaner and firmer, the proportion of sand to mud being much greater, the strong current flowing over the beds having the effect of keeping them clean. The oysters are entirely raised from spat which falls on the beds. The principal buyers of these oysters are Petrie, Mussen, Hardy, and M'Donald, who own layings in the vicinity of the beds, and who lay the smaller oysters on their beds to grow. The larger oysters are sent off direct to Liverpool, Manchester, Dublin, Belfast, &c., &c., packed in boxes or barrels on the shore, and forwarded by rail and steamer to their destination.

DUNDALK RURAL DISTRICT.

PRIVATE OYSTER LAYINGS.

Messrs. Mussen and Co., of Liverpool, are the owners of two licensed oyster beds, one situate on the western foreshore, opposite the townland of Ballinteskin, on the estuary of the River Ryland, extending to low water mark for about 500 yards along the shore. The area of the bed is 54 acres, of which only about 12 acres are stocked, the oysters being laid between half-tide and low water of spring tide. The ground formation is a mixture of gravel, sand, and mud, and the bed is clean and well looked after. The other oyster bed is situate on the eastern shore of Newry River on the opposite side to Warrenpoint. It covers an area of 96 acres between high and low water marks, but only a small portion of the bed—about 20 acres near its centre—as marked in red on the map, is stocked. The oysters are laid between half-tide and low water of spring tide. The bottom formation is similar to that of the other bed, but with a larger proportion of mud, and the ground is clean. These beds are worked in conjunction, and are used almost entirely for laying down American oysters for fattening. Some native oysters are also laid down. The American oysters come from Blue Point and East River, and are sent packed in barrels, each containing on an average 1,100 oysters. No seaweed or other substitute is used in the packing of the barrels. On arrival at Liverpool the oysters are sent by steamer direct to the beds and are laid during the months of March and April. 2,200 barrels of oysters were laid down on the beds this year, but in former years the quantity laid down was much in excess of this. From the 1st July until the end of October, oysters are taken from the beds and packed with sea-weed in barrels and sent by steamer to Liverpool, consigned to Messrs. Mussen and Co., wholesale merchants, who dispose of them to dealers at sea-side resorts, such as Blackpool, Isle of Man, &c., &c. All of the oysters laid on the beds are disposed of each season.

The time occupied in transit from America until the oysters are laid down on the beds would average from ten to twelve days. Some oysters on top of the barrels are occasionally found to be dead on arrival. Sixteen persons are employed working on the beds during the season under the superintendence of Mr. Patrick Guy, Omeath.

Mr. Guy handed me a certificate issued by the Board of Health of the Town of Islip, State of New York, from which place the oysters are sent to England. A similar certificate accompanies each consignment of oysters, and goes to show that the oysters are obtained from untainted sources.

FORM OF CERTIFICATE.

TO WHOM IT MAY CONCERN :

We, the undersigned, composing the Board of Health of the Town of Islip, County of Suffolk, New York, do hereby certify that the water of the Great South Bay fronting the Town of Islip, covering the entire area where the Blue Point Oysters are raised and grown, is absolutely free from any contamination from sewage, drainage, or any other source whatsoever.

The regulations and ordinances of the Board of Health, which are rigidly enforced, prohibit the draining of any cesspool or closet into any running water which empties into the waters of the Great South Bay. The throwing of garbage of any kind into either the Bay or water running into the same is strictly forbidden. The ordinances requiring that all closets and cesspools shall be cleaned once every month and contents removed in tight receptacles, and buried over three hundred feet from any water or running stream.

In witness whereof, we have hereunto set our hands and seal this
day of _____ 190 .

President and Superior.

Secretary and Town Clerk.

} *Justices of the Peace.*

Health Officer.

Citizen Member.

(Seal of the Town of Islip
Suffolk Co., N. Y.
1633.)

Mr. PETRIE'S OYSTER LAYINGS.

This bed is owned by Mr. Petrie, wholesale fish merchant, Liverpool, and is not licensed. It is situate on the western shore of Newry River, about one mile further up the river than Mr. Mussen's oyster bed, opposite Warrenpoint, and is situated in Dundalk Rural District. The bed contains about an acre, and extends from half tide to low water mark. It is used for the layings of American oysters and occasionally native oysters bought from local fishermen. 3,000 barrels of American oysters were laid down on the beds last season. The oysters remain on the bed for periods varying from two to six months, and are sent off, packed in bags, from 1st July to end of October, by steamer, to Mr. Petrie, Liverpool, and to Marshall and Keyworth, wholesale fish merchants, Manchester. Each bag contains about 500 oysters. Consignments are sent off almost daily. The bed is used for fattening and storing oysters pending sale, as American oysters could not be sent to England from America during the summer months owing to the heat and time occupied in transit, which would be fatal to oysters.

The bottom formation of the bed is a mixture of gravel, sand, and mud, and the ground is firm and clean. Fourteen persons are employed on the bed during the season under the superintendence of Mr. Quinn.

All oysters from this bed are sent to England.

Mr. McDONALD'S OYSTER LAYINGS.—DUNDALK RURAL DISTRICT.

Mr. McDonald has two unlicensed oyster layings on the western shore of Newry River. One adjoins Mr. Petrie's, opposite Narrow Water Castle, and the other is situate about 500 yards further up the river towards Newry. The extent of the layings is about one rood situate between half tide and low water marks. The ground formation is gravel, with a mixture of sand and mud, and is clean. 15,000 barrels of American oysters were laid down on the bed during the past season (March and April), and from November to March native oysters dredged from public beds in Carlingford Lough and Newry River are laid down on the bed pending sale. About half a million native oysters were purchased from fishermen during the past season, some of which were sent off direct to Mr. McDonald's shops in Liverpool, and to wholesale dealers in Liverpool and other customers, while those not sold were laid down on the bed for periods varying from a few days to twelve months.

The oysters are despatched from the beds packed with seaweed in barrels and bags, by rail and steamer, those for across-Channel being sent in barrels. Mr. McDonald has places of business in Liverpool, Isle of Man, and elsewhere, where he disposes of oysters by retail. (Some are sent to Morgan and M'Ennery, Belfast; Doobyn, Banbridge; Traynor, Armagh, &c., &c., and some are disposed of in Warrenpoint and Newry.)

Eight persons are employed on the bed during the season from July to end of October.

Mr. HARDY'S OYSTER LAYINGS.—DUNDALK RURAL DISTRICT.

This laying adjoins Mr. McDonald's, opposite Narrow Water Castle, is under one rood in extent, and situated above low water mark on the foreshore. It is not licensed. The bottom formation is similar to adjoining beds, and is clean. About 400 barrels of American oysters from East River are laid down during the months of March and April each year, and taken up again from July to end of October. The oysters are sent off in bags containing 500 oysters, to Keyworth and Son, and Whitehead and Son, wholesale fish merchants, Manchester; Leaven and Hanlon, Dublin; M'Innery, Belfast; O'Hagan, Dundalk; Marley, Newry; and several private customers.

Mr. Hardy also buys oysters dredged in Carlingford Lough from the fishermen. About 300,000 were purchased during the past season (November, December, and January), most of which were sent off direct packed in barrels with seaweed, and in smaller quantities in bags; those not disposed of at once were stored on rings on the foreshore close to low

water mark near Omeath, where they remained for periods varying a few days to some weeks, until disposed of. The native oysters were sent chiefly to Dublin (Hanlon, Moore-street, Red Bank Restaurant, and Burlington Restaurant); Carroll, Liverpool, &c. Only one person is employed on the bed.

MUSSELS.

Mussels are picked on the shores of Carlingford Lough and Newry River at low water. About 21 tons are exported annually to Liverpool and Manchester markets. They are sent by steamer packed in bags.

PERIWINKLES.

I was informed that small quantities of periwinkles are from time to time collected from the same places as the mussels, and are disposed of locally.

COCKLES.

No cockles are collected in Carlingford Lough.

Possible Sources of Contamination of Carlingford Lough and Newry River.

The chief pollution of the Newry River and Carlingford Lough is the sewage of Newry and Warrenpoint, which is discharged in its crude state direct into the river. In the case of Newry, the sewage is discharged at a point about four miles distant from the nearest oyster beds or from places where shell-fish are collected. The population of Newry is 12,587. The number of water-closets, including the Fever Hospital drainage, in connection with the system of sewerage, is 1,168. At low states of the tide the volume of water in the river is small, so that a considerable portion of it is composed of Newry sewage, and this, as it finds its way seaward, passes over the public oyster beds, and close to private layings. The latter being situate above low water mark would only be affected by it on the last of the ebb and beginning of flood tides, and to a much lesser degree than the public bed in the channel of the river.

Warrenpoint, a favourite seaside resort, has a normal population of 1,817, which, during the summer months, is largely increased. It is drained on the water carriage system. There are two main sewer outfalls, one near the Railway Station and the other close to the Custom House, both discharging on the foreshore above low water mark. Both of these sewer outfalls are within 200 yards of the public oyster fishery in the Newry River, and that near the Railway Station is within 400 yards of one of Mr. Mussen's layings, from which it is, however, separated by the channel of the river.

Rostrevor, with a population of 800, discharges its crude sewage within half a mile of the public oyster fishery in Carlingford Lough, and the sewage from the Hotel at Greenore is discharged within about one mile of the nearest point of the same bed. In addition, several private houses on the shores of the Lough are drained directly into it.

The vessels entering the Lough each year number over 800, representing a tonnage of over 100,000.

There is also the drainage from the villages of Carlingford and Omeath, but this is composed chiefly of surface and slop water.

Having regard to all these facts, Newry River cannot be regarded in the light of a safe locality for oyster beds or layings. In fact oysters in this river must be considered as occupying a dangerous position as regards pollution.

The public oyster bed in Carlingford Lough and the private layings, owing to the great expanse of water in the Lough and the greater distance from the sewer outfalls, are much less liable to contamination.

Enteric Fever, Attributed to Consumption of Shell-fish.

During the past three years thirty-one cases of enteric fever occurred in the Carlingford Dispensary District, which extends along the eastern shores of Carlingford Lough and of Newry River, up to the highest point where oysters are laid or dredged. The Medical Officer of the District (Dr. Finnigan) attended nearly all the persons affected, and in each case made careful inquiries as to the probable source or sources of infection. He arrived at the conclusion that thirteen of the cases were caused by eating oysters procured from Newry River, and six cases to eating cockles obtained from the strands in Dundalk Bay. The twelve remaining cases occurred subsequently among members of the same families as those affected, and were not directly due to the ingestion of shell-fish.

Doctor Finnigan states that for some years past he has noticed that enteric fever makes its appearance soon after the open season for oyster fishing commences (November) and continues until February (the close season begins in the middle of January). During the Spring and Summer of last year, however, the enteric fever cases (ten) attributed to the eating of cockles occurred.

Dr. Glenny, a private medical practitioner residing at Omeath, saw several of the patients affected with enteric fever, and is also strongly of opinion that the disease was caused by the ingestion of shell-fish.

With one or two exceptions, I visited all the families where cases of the disease had occurred, and made exhaustive inquiries as to all possible sources of infection. I was unable to find any cause likely to give rise to enteric fever, except the shell-fish. The sanitary arrangements, water supplies, &c., appeared to be quite satisfactory except in one instance, where the well from which the family obtained its water supply was open to pollution by fowl and cattle having access to it. Other families, however, used the water from the same well and none of them contracted enteric fever. I found that some of those affected were employed in dredging for oysters immediately prior to the attack, and had partaken of oysters within the incubation period of the disease; others not so employed had eaten some of the oysters which they got from the persons engaged in dredging for them, and developed enteric fever in from ten days to three weeks afterwards.

Of the ten cases attributed directly or indirectly to the eating of cockles, I found that six had partaken of cockles within from one to three weeks of the date of the attack. In the case of one family which partook of the cockles, the only member who developed enteric fever ate the cockles in their raw state, the other members of the family took them cooked. This case occurred at the Coastguard Station, Greengore, and, as far as I could ascertain, there was no other cause for the outbreak. The cockles were collected on the strand, near Dundalk, over which the sewage of Dundalk passes on its way out to sea. Four additional cases of enteric fever occurred subsequently in some of the families previously attacked.

As having a possible bearing on these outbreaks of enteric fever in the Carlingford Dispensary District, near Omeath, I made inquiries as to the number of cases of enteric fever notified as having occurred in Newry during the years 1901-3, and found that for the year ended 31st March, 1901, 11 cases were notified, for 1902, 17 cases, and for 1903, 41 cases.

COAST OF COUNTY OF LOUTH.

DUNDALK BAY.

ESTUARY OF CASTLETOWN RIVER.—DUNDALK URBAN AND RURAL DISTRICTS.
(Map No. 28.)

Dundalk Bay is an inlet of the Irish Sea, situate on the coast of County Louth, between Coolay Point and Dunany Point. It is about eight miles wide at its mouth, and narrows gradually to a small channel at its head near Dundalk, which is about ten miles distant. It is navigable as far as Dundalk through a narrow channel which extends for nearly half the length of the bay between the North and South Bull banks. These banks are exposed at low water.

MUSSELS.

Mussels are collected along the banks and dredged from the bed of the channel from the Quay at Dundalk to No. 3 Perch or Beacon, a distance of about two and a half miles. They are dredged from August till the end of May, six boats and about thirty persons being employed. The quantity collected annually is about 150 tons, and is sent packed in bags by steamer and rail to Manchester, to Messrs. Watson, Marshall, and Sons, Keyworth; Shaw and Woods, wholesale fish merchants.

COCKLES.

Cockles are collected on the North and South Bull Strands, opposite Bellurgan on the north side, and Blackrock on the south side. About forty persons are engaged collecting them from March till the end of September. The quantity collected daily is about 6 cwt. The cockles are disposed of locally and in Belfast, Drogheda, Newry, and smaller towns in district. None are exported.

PERIWINKLES.

Periwinkles are collected all along the shores of Dundalk Bay; about 100 tons are shipped annually to London, Liverpool, Manchester, and other towns in England. They are sent off packed in bags.

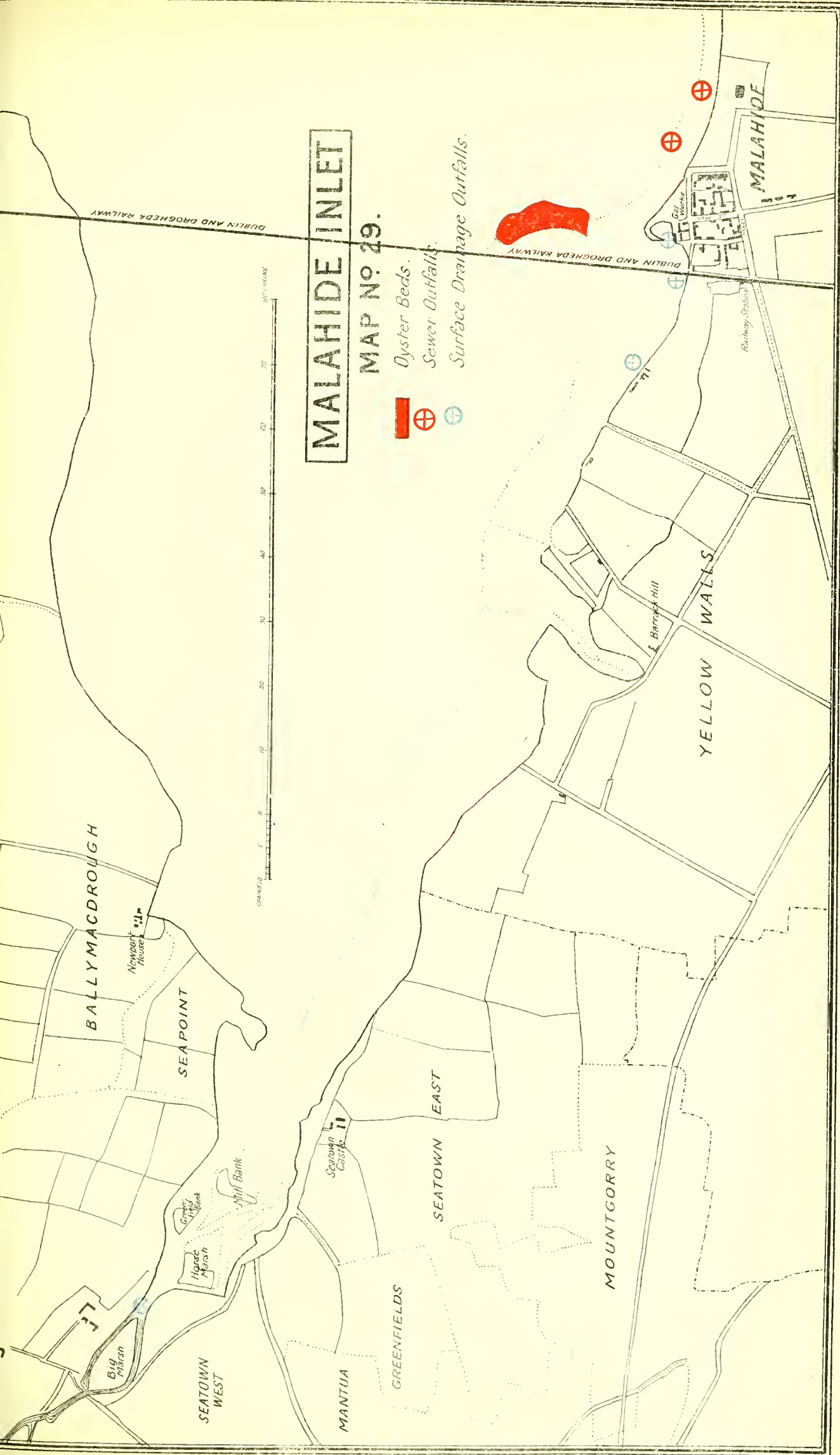
Possible Sources of Contamination.

The sewage of Dundalk, which has a population of 13,067, is discharged in its crude state direct into the river at the Quay, and within a few yards of where mussels are taken from. The town is drained on the water carriage system, so that the quantity of excrementitious matter entering the river is very considerable, and leads to gross pollution of mussels and other shell-fish collected in the vicinity of the outfall. The cockle strands, some three miles further down stream from the sewer outfall, would, in a much less degree, be liable to pollution. The river is discoloured for some distance below the outfall by the sewage effluent. (See report on Carlingford Lough.)

The vessels passing up and down the river, of which the number is considerable, would also, to a small extent, be a probable source of pollution.

ESTUARY OF RIVER BOYNE. (Map 28.)

The River Boyne flows into the Irish Sea between Crook Point in County Louth and Maiden Point in County Meath. The river is of considerable dimensions, and is tidal to above Drogheda, a distance of about five miles from the sea. Vessels up to 400 tons measurement can proceed up the river as far as Drogheda. There is a daily service of steamers between Drogheda, Liverpool, and Glasgow. The channel of the river is over 100 yards wide, throughout its distance from Drogheda to the sea.



MALAHIDE INLET

MAP No 29.

Oyster Beds.

Sewer Outfalls.

Surface Drainage Outfalls.



BALLYMACDROUGH

SEAPOINT

SEATOWN WEST

MANTUA

GREENFIELDS

SEATOWN EAST

MOUNTGORRY

YELLOW WALLS

MALAHIDE

Newport House

Grange Bank

Mill Bank

Seapoint Castle

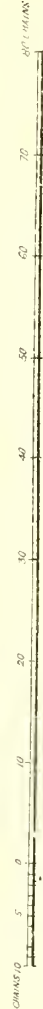
Barrack Hill

Golf Course

Railway Station

DUBLIN AND DROGHEDA RAILWAY

DUBLIN AND DROGHEDA RAILWAY



MUSSELS.

Mussels are dredged from the bed of the River Boyne from Mornington village to near the mouth of the river, a distance of about two miles. Nineteen boats are employed at dredging from 1st October till 31st March each year. During the close salmon fishing season on the river about 60 tons of mussels are exported by steamer to Liverpool and thence to Manchester by rail. They are sent off daily packed in bags to wholesale merchants in Manchester and Liverpool—Messrs. Smith, Watson, Marshall, Woods, and Whitebutt, Manchester, and Hurley and Millar, Liverpool. In the part of the river from which mussels are dredged, the bottom formation is shingle, sand, mixed with a dark coloured mud.

Possible Sources of Contamination.

The sewage of Drogheda, which has a population of 12,760, is discharged in its crude state into the river about two miles above the nearest point at which mussels are dredged. The town is drained to a great extent on the water carriage system, and the quantity of excrementitious matter finding its way into the river is very considerable. Several private houses along the banks of the river also drain direct into it, and, in addition, there is the shipping to be considered. It would appear, therefore, that the mussel beds are not free from suspicion of contamination.

No other kind of shell-fish is collected on the Boyne River.

COAST OF COUNTY OF DUBLIN.

MALAHIDE INLET.—BALROTHERY RURAL DISTRICT. (Map No. 29.)

Malahide Inlet opens off the Irish Sea on the coast of County Dublin, and extends inland for a distance of two and a half miles to the mouth of Broadmeadow River.

The Inlet is narrow at its entrance opposite Malahide, and inside Malahide Point it broadens out to a width of a mile at high water. At low water there is a great expanse of sand banks on either side of a narrow channel which extends the whole length of the inlet, and is from one-half to two fathoms in depth as far as the Railway Bridge, crossing the inlet a little to the north-west of Malahide.

MALAHIDE OYSTER LAYINGS.

Lord Talbot de Malahide is the owner of a chartered oyster bed situated on the foreshore close to the eastern side of the Railway Bridge. The bed is leased to Mr. Petrie, wholesale fish merchant of Liverpool, who uses it for the purpose of laying down oysters. These are chiefly American, but some are also laid down from Tralee Bay public oyster fishery and Carlingford Bay. The American oysters come from East River and Blue Point, and are laid down during the months of March and April, and taken up again from 1st May till end of October. Last season 1,000 barrels were laid down on the bed. Each barrel averages close on 1,200 oysters. The oysters improve very much on the bed during their short stay. They are sent off by rail and steamer direct from the bed, packed in bags, each bag containing 500 oysters, consigned to Mr. Petrie, Liverpool; 10,000 to 20,000 oysters are sent off daily during the season. During last season 100,000 oysters from Tralee Bay and Carlingford Lough public beds were laid down to grow and fatten, and pending sale when demand for oysters was slack.

The area of the oyster bed is about three acres, situate above low water mark. There are three parcs, each enclosed with large stones, and it is on

these parcs the oysters are laid. The bottom formation is a mixture of coarse sand and bluish mud. The parcs are kept clean and free from weeds, but other portions of the bed not under cultivation are foul and overgrown with weeds.

During the present season no oysters have been laid down. Three men are employed on the bed during season. Mr. Glin, the manager, informed me that American oysters are from ten to twelve days in transit from America before arriving at the bed, and that frequently some of the oysters on top of the barrels are dead on arrival.

Possible Sources of Contamination.

The town of Malahide, with a population of 649, is drained into the foreshore, opposite the town, the sewer outfall being a short distance above low water mark. I was informed that there are only about six water-closets in connection with the public sewer. The Grand Hotel, situated at the eastern end of the town, is drained by a private sewer, the outfall of which is some fifty yards to the east of the public sewer outfall. Both these sewer outfalls are to the seaward of the oyster bed, and distant from its nearest point about 600 yards. The effluent from the sewers could only reach the oyster bed on flood tide, if at all, and then only in a very diluted form. There are also a few surface drains discharging into Malahide Inlet, the nearest being about 500 yards distant from the oyster bed. These drains discharge only surface and slop water in small quantities, scarcely noticeable in dry weather.

Having regard to all the facts, I consider the risk of pollution of the oyster bed to be very slight.

DUBLIN BAY.

Dublin Bay lies between the Hill of Howth on the north and Sorrento Point, Dalkey, on the south. It is about five miles in width at its mouth, and extends for about four miles to the entrance to the River Liffey. The City of Dublin, with a population of 290,638, and the adjoining townships of Rathmines and Rathgar and Pembroke, with a combined population of 58,401, are situate on or close to the River Liffey. The township of Kingstown, with a population of 17,592, Blackrock (8,719), and Dalkey (3,398), are situate on the shore of Dublin Bay, into which all these places are drained.

SUTTON CREEK OYSTER LAYINGS.—NORTH DUBLIN RURAL DISTRICT. (Map No. 30.)

Lord Howth is the owner of a chartered oyster bed situate in Sutton Creek on the foreshore opposite St. Fintan's-terrace, and the Cottages, Sutton, between high and low water mark. The extent of the bed is about 8 acres. It is leased to Messrs. Mussen and Company, Liverpool, and is used for laying down oysters, chiefly Americans, also oysters from Portugal, and sometimes oysters from Carlingford Lough, Tralee Bay, Arklow, North Sea, and France. The oysters remain on the bed for one to six months. They are usually laid down during March and April and taken up from May till September. About 12,000,000 oysters are laid down each season on six parcs, which are walled around with stones, and are situate just above low water mark. The oysters are sent off three times weekly, from May till September, by rail and steamer, to Messrs. Mussen and Company, wholesale fish merchants, Liverpool. They are packed in barrels, each barrel containing about 1,200 oysters. No seaweed or other substance is used in the packing. As many as 100,000 oysters are sent off during one week. About 400 oysters are sent weekly to a retail dealer in Dublin (Harvey, Camden-street). The oysters are laid down on the bed to store pending sale. Six persons are employed on the bed during the season. The bottom formation is a mixture of gravel, sand, and mud, and is firm and clean.

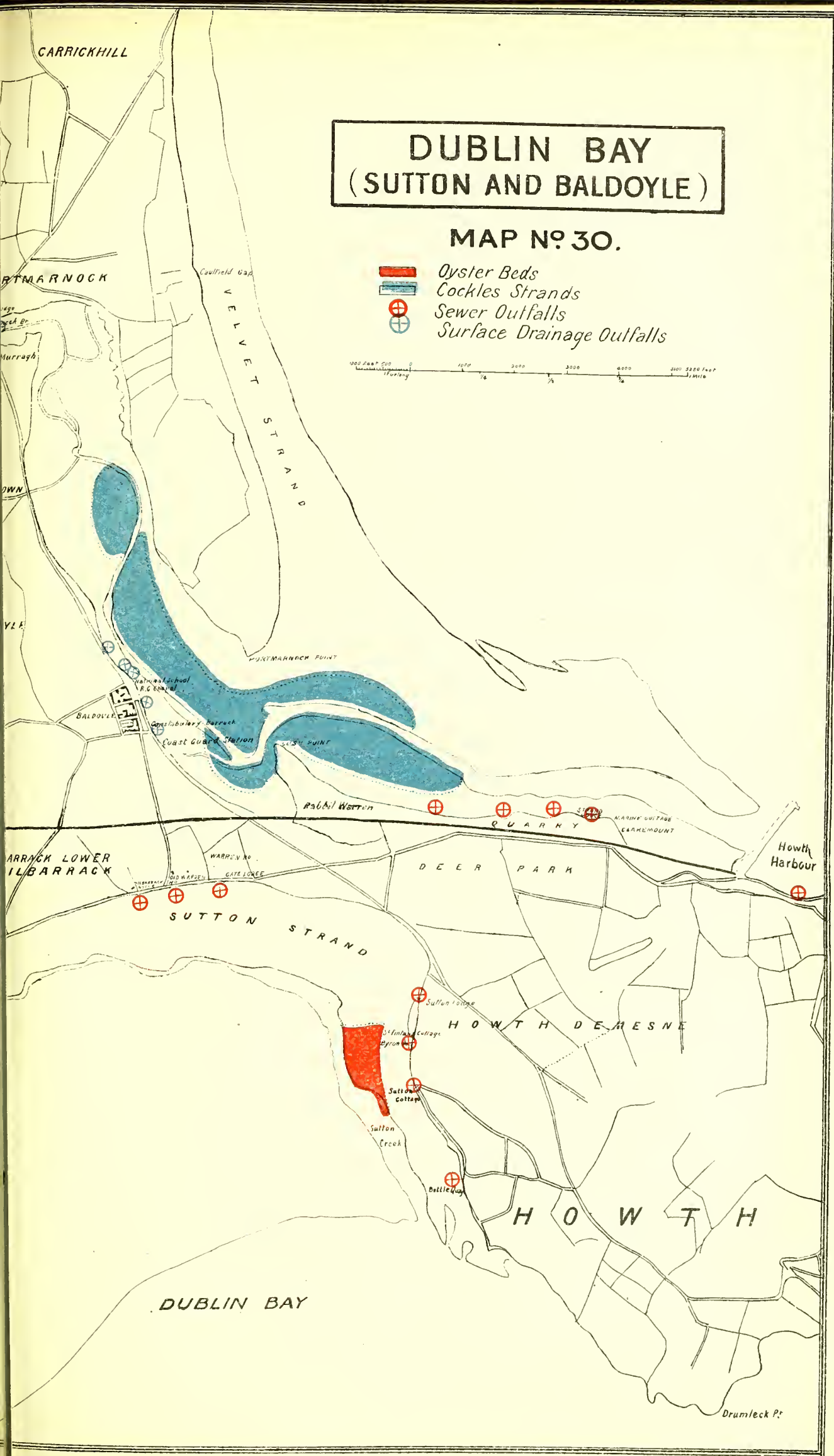
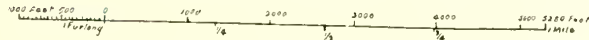
CARRICKHILL

DUBLIN BAY (SUTTON AND BALDOYLE)

MAP N° 30.



Oyster Beds
Cockles Strands
Sewer Outfalls
Surface Drainage Outfalls



Possible Sources of Contamination.

There are about thirty houses within a distance of about 1,000 yards of the oyster laying. These houses are, as a rule, drained separately into the foreshore opposite. The nearest sewer outfall to the laying is about 200 yards distant. Between the bed and Clontarf several private houses are drained into the foreshore, as is also Dollymount. The sewage of Dublin City, Rathmines, Rathgar, and Pembroke is discharged into the River Liffey at various points in its course, and enters Dublin Bay at Poolbeg Lighthouse, about two miles distant from the oyster layings. The current, I was informed, sets in the direction of the oyster bed for nine hours out of twelve. There is also the sewage of Clontarf, Sandymount, Merrion, Blackrock, Kingstown, and other smaller places, finding its way into Dublin Bay. In addition, pollution may be caused by the shipping entering the Port of Dublin, and by the deposit in the Bay of the refuse, &c., collected by the scavenging staff of Dublin. Having regard to all these facts, I am of opinion that not alone this oyster laying, but all shell-fish in Dublin Bay are more or less subject to contamination.

COCKLES.

Cockles are gathered on the strand opposite Baldoyle village, around Portmarnock Point, and on the Baldoyle Spit, to the north of the Hill of Howth. There appears to be little danger of pollution.

As regards the shell-fish layings in other portions of Dublin Bay, these have, I understand, been dealt with in reports* made to the Board by Dr. D. Edgar Flinn, Medical Inspector for the District.

DESCRIPTION of TREATMENT which OYSTERS are subjected to from the time they are received from oyster beds, &c., until they are consumed.

I visited the places of business of nearly all of the wholesale and retail dealers in oysters in Dublin with a view to ascertaining particulars as to the storage of shell-fish, the possibility of contamination whilst in store pending consumption, length of time kept, &c., &c.

As a rule, I found that consignments of oysters were received two or three times weekly and stored in shops or special places provided for them. The oysters are kept in the boxes, barrels, or bags in which they are sent until disposed of, and as regards suitability of places of storage, cleanliness of surroundings, length of time kept, &c., with few exceptions no fault could be found. In a few instances, I found that the places where oysters were stored were not clean, and that oysters were kept sometimes for more than a week or until they had to be thrown away as unfit for use. This applies particularly to oysters which have come direct from the American oyster beds and have not been relaid on beds in this country prior to sale. Many of these oysters are found on arrival to have perished in transit, particularly those on top of the barrels. The American oysters are retailed largely, and in two instances I found them exposed for sale in a putrid state.

The oysters got from the Irish beds are procured in small quantities two or three times weekly, and are never kept for more than three days in store before consumption. They are generally very carefully packed in boxes with seaweed, but in some instances they are sent in barrels, or bags, without any seaweed around them, in which case they would not be likely to remain alive for so long a period.

* See pages 72 to 79.

ESTUARY OF RIVER LIFFEY. (Map No. 31.)

REPORT by Dr. D. EDGAR FLINN, Medical Inspector.

The estuary of the Liffey is bounded on the north by Fairview and Clontarf, and the north breakwater or North Bull extending to the Bull Lighthouse, and on the south side its boundaries are the Pigeon House Wall, the Poolbeg or Great South Wall, extending to the Poolbeg Lighthouse, the length of the northern boundary being about five and a half miles, and that of the south about four and a quarter miles. The estuary at its widest part is about one mile and a quarter.

All the north flowing drainage of the mountainous range on the southern border finds its way into the River Dodder, which flows eastward and empties into the mouth of the Liffey. The latter river takes the drainage from the plains of Kildare to Dublin Bay. The River Tolka running parallel to the Liffey, about two miles further north, discharges into the estuary of the Liffey near Clontarf.

The foreshore at Clontarf is always laid dry at low water, and the sewage of a large and populous district is discharged directly on to the foreshore there. The entire estuary receives the crude sewage of the City of Dublin as well as that from the recently added Urban Districts of Clontarf, Drumcondra, and Glasnevin.

Within this area, according to the Census of 1901, there is a population of 290,638 persons, 32,061 inhabited houses, this area being 7,911 acres in extent.

Owing to the general adoption of the water-closet system, the pollution has increased very considerably in recent years, and there is ample evidence of this pollution everywhere.

OYSTERS.

At the Fairview and Clontarf portion of the estuary the sewage-saturated condition of the foreshore is very apparent. In this immediate vicinity are situated the Clontarf oyster layings, which I have dealt with in a separate report.* A more unfavourable ground for the collection of shell-fish can hardly be imagined than the strand and foreshore at Clontarf.

COCKLES.

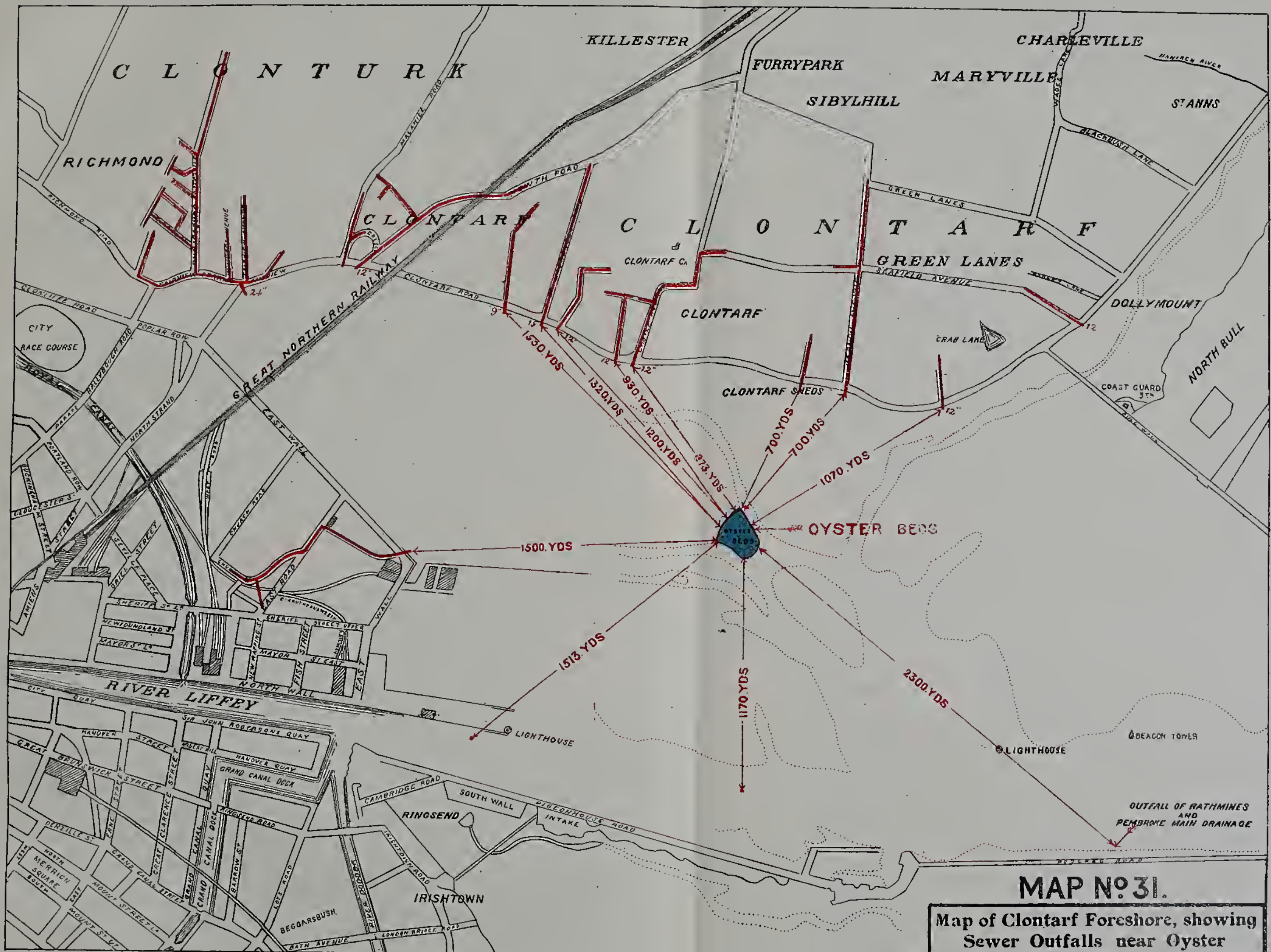
Cockles are gathered in very large quantities in the vicinity of Dublin, and a great number of people earn a livelihood by hawking and selling them in the poorer quarters of the city. At low water during the spring, summer, and autumn months, the strands on the southern shores of Dublin Bay are sometimes crowded with cockle gatherers.

It is difficult to ascertain accurately the amount of cockles consumed in Dublin; it is, however, well known that cockles are very largely eaten all the year round in the city, particularly in the summer and autumn months. I can only arrive at an approximate estimate of the amount from information that I have received. It is probable that from about seventy to eighty thousand quarts of cockles are eaten in Dublin annually. At least three-fourths of this large quantity is eaten in a raw state; they are, however, nearly always eaten when freshly gathered.

Cockle gatherers have stated to me that, as a general rule, they are able to dispose of the contents of their baskets in a comparatively short time after having gathered them.

Some of the localities from which cockles are collected are, as previously stated, so obviously liable to pollution from sewage matter, that a grave danger is incurred by the consumption of this class of shell-fish, and it seems a not unlikely contingency that many of the cases of acute diarrhoea and vomiting, as well as attacks of gastro-enteritis, that occur in Dublin at certain seasons of the year might be traced to the eating of this class of shell-fish gathered from polluted sources.

* See page 74.





The cheapness of cockles as an article of dietary brings them within the reach of the poorer classes (threepence a quart being the usual charge), hence their consumption is considerable, and a large number of people gather them in addition to those who earn a livelihood by selling them.

MUSSELS.

Mussels are not much gathered, nor are they plentiful on the foreshores of Dublin Bay, the locality not being favourable to their propagation. Mussels from Dollymount and Blackrock have been submitted for bacteriological examination to Professor McWeeney.

PERIWINKLES.

Limited consignments of periwinkles find their way into the city principally from Skerries and north county of Dublin District. They are, as a rule, eaten cooked.

SHELL-FISH SHOPS.

As a general rule the shell-fish shops in Dublin are kept in a cleanly condition, the exceptions to this rule being very few. In some of the smaller shell-fish shops, however, the facilities for storage are not as satisfactory as they should be, the accommodation being limited, the ventilation deficient, and the sleeping apartment being frequently situated immediately behind the shop. It also happens that if there is not a quick sale for oysters, or other shell-fish, there is the danger of their being kept too long or perhaps mixed with a fresh consignment; this sometimes does occur, and the danger to the poorer class of consumer is obviously considerable. The street hawkers, as a rule, dispose of their shell-fish rapidly.

SOUTHERN BORDER OF DUBLIN BAY.

On the south side of Dublin Bay a very wide area of strand is exposed at low water, extending from Irishtown, Sandymount, and Merrion to Booterstown and Blackrock, a distance of three and a half miles. This stretch of foreshore is now, on the whole, comparatively free from pollution since the completion of the Blackrock and Kingstown Main Drainage System and the Rathmines and Pembroke Drainage Scheme. There is, however, still evidence of some sewage pollution of the foreshore at Merrion and Blackrock. In the vicinity of the Railway Station at Blackrock the pollution is plainly visible. This area is largely resorted to by cockle gatherers, and is regarded as the best gathering ground for cockles in the vicinity of the city. Previous to the initiation of the sewerage schemes mentioned above, this foreshore was greatly polluted by the sewage from the populous districts of Blackrock, Booterstown, Sandymount, and Irishtown. Notwithstanding this fact, this district had then the reputation of being the best locality for gathering cockles. Practically all the strands around Dublin until recent years were polluted with sewage matter, and the consumption of shell-fish (particularly cockles) has always been very large in the poorer districts of the city. Clontarf strand and foreshore still suffer in this regard, and shell-fish from that district in considerable quantities still find their way into the city.

GENERAL OBSERVATIONS.

It is a question as to the part that shell-fish may have hitherto played as one of the causes of Enteric Fever in Dublin. Shell-fish gathered from polluted areas, such as existed and still exist within the estuary of the River Liffey, must be regarded with suspicion, and from inquiries that I have made, although precise information on the point is not available, it seems probable that the ingestion of shell-fish from these tainted sources has played no inconsiderable part in the history of enteric fever in Dublin. Further reference will be made to this question in my report on the causes of the high death-rate in Dublin.

At various times during the past few months, I personally collected samples of cockles and mussels from the north and south borders of Dublin Bay. These samples were submitted for bacteriological examination to Professor McWeeney, whose report is appended. It would be very desirable, if not absolutely necessary, that the gathering of shell-fish (cockles), at least within that portion of the estuary situated at Clontarf, should be discontinued until such time as the sewerage of this populous district has been dealt with. The polluted condition of the foreshore here constitutes a grave danger from the fact of there being such a large number of main sewers discharging crude sewage directly on to its surface.

D. EDGAR FLINN.

June 30th, 1903.

OYSTER LAYINGS AT CLONTARF.

REPORT by Dr. D. EDGAR FLINN, Medical Inspector.

The position of the Oyster Beds at Clontarf cannot be regarded as satisfactory, or as fulfilling the conditions generally recognised as being essential to the safeguarding of such places from pollution.

The sewerage of Clontarf and Dollymount is discharged at several points along the foreshore—these points of discharge of the main sewer outfalls are marked on the accompanying Map (No. 31), and it will be seen that the position of the oyster layings, or beds, are comparatively close to several of the outfalls; from a point at Fairview Strand to Dollymount, a distance of nearly three miles, there are fifteen main sewer outfalls discharging crude sewage on to the foreshore, and immediately opposite to the position of the oyster beds there are several such outfalls, two of them being only 700 yards distant.

It will further be observed that the Channel of the River Liffey, into which the unpurified sewage of the City of Dublin is at present discharged, is 1,513 yards, and the outfall of the Rathmines and Pembroke Main Drainage System is 2,300 yards distant from the layings.

The Clontarf beds are largely used for the laying down of oysters at certain seasons of the year. Numerous consignments of American Blue Point and East River Oysters are brought there in March and April from Liverpool for the purposes of being "fattened." Other consignments arrive in November. These oysters remain on the Clontarf beds for periods, I understand, ranging from three to six months, when they are placed on the markets for sale.

Consignments from the district of Oranmore, County Galway, are also forwarded periodically and placed on the beds for the same purpose.

It will be observed that the oyster layings at Clontarf are practically surrounded on all sides by sewer outfalls at variable distances ranging from 700 to 2,300 yards, in addition to the principal sewers, as marked on the Ordnance Map, there are several other minor sewers that also discharge on to the foreshore.

Having regard to the increase of the population, and the number of inhabited houses, the volume of crude sewage matter that now finds an outlet on the foreshore at Clontarf and Dollymount is very much in excess

of what it was in former years. In 1891 the number of inhabited houses in this area was 979—the number of inhabited houses, according to the Census of 1901, is 1,332, and the population is just 7,000.

Portions of the city of Dublin sewage must, of necessity, find its way into the locality where these oyster beds are situated.

On the date of my first visit to Clontarf Professor M^cWeeney accompanied me, and he collected several samples of oysters at various points. The result of his examination* reveals the fact that the oyster layings at Clontarf are polluted, as the samples examined by him were clearly contaminated with excrementitious matter.

The appearance of the mud on the foreshore and in the vicinity of the oyster layings presented an appearance indicative of sewage saturation, and a further bacteriological examination will be made by Professor M^cWeeney of the mud and sea water.

The presence of the *Bacillus coli communis* in the oysters already examined from the Clontarf layings is evidence that the position of the beds cannot be regarded in any sense as satisfactory. The presence of the *Bacillus coli communis*, it will be observed, was detected in practically all the samples examined by Professor M^cWeeney.

Whatever justification may have hitherto existed for the selection of Clontarf as a suitable ground for oyster laying, it cannot now be regarded as such in view of the pollution to which the foreshore in the immediate vicinity is subjected.

I shall further deal with this question in my report on the causes of the high death rate in Dublin. I further propose to have some photographs taken of the foreshore (showing the position of sewers) at low water, to be attached to such report.

D. EDGAR FLINN.

March 16th, 1903.

Addendum to Report.

The area of the layings is about ten acres, one-half of which has been usually covered with oysters imported from various sources. About 3,000,000 oysters are annually taken from the layings and forwarded for consumption to various centres in both England and Ireland. These oysters, for which there has been hitherto a considerable demand, are largely partaken of at many of the watering places on the West Coast of England.

I desire to thank Mr. Spencer Harty, City Surveyor, who was good enough to furnish me with a map showing the sewer outfalls and their respective distances from the oyster layings at Clontarf.

D. EDGAR FLINN.

September, 1903.

* See page 77.

OYSTER LAYINGS AT CLONTARF.

REPORT by Professor E. J. McWEENEY, Bacteriologist to the Local
Government Board for Ireland.

84, ST. STEPHEN'S GREEN,

DUBLIN, 13th March, 1903.

SIR,

I beg to report that on the 22nd January, 1903, I visited, in conjunction with Dr. Edgar Flinn, Medical Inspector of the Board, certain oyster-layings at Clontarf, County Dublin, and removed therefrom samples of oysters and cockles which I have since subjected to bacteriological examination.

I have also received from Dr. Browne, Medical Inspector to the Board, very numerous samples of oysters and other shell-fish from the South of Ireland as well as of the sandy mud from the beds themselves, and of the supernatant sea-water.

The minute bacteriological examination to which I have subjected these materials has opened up a number of interesting questions bearing on the hygienic aspect of the shell-fish industry, such as the reliability of the bacterial evidence of sewage-contamination, the claims of the coli-form organisms isolated from shell-fish to be regarded as genuine *Bacillus coli communis* of faecal origin, and the significance and nature of *B. enteritidis sporogenes*.

With these questions I intend dealing in a report which I have at present in course of preparation, and hope to present next week.

I do not think, however, that I ought to withhold any longer than absolutely necessary the result of the bacteriological examination of the Clontarf shell-fish, and I therefore now beg to report as follows:—

The Clontarf shell-fish fall into the following groups:—

- (a.) So-called "American Blue-point" Oysters, taken near the spot where oysters were being collected and loaded on to a cart at the time of our visit.

(Two collected, both examined.)

- (b.) So-called "East-river" Oysters laid down in November last.
(Eight collected, six examined.)

- (c.) "East-rivers," laid down in March last.
(Six collected, all examined.)

- (d.) Living oysters picked by us out of large accumulation of dead oysters and empty shells.
(Five collected, all examined.)

- (e.) Oysters from most inland part of bed.
(Four collected, all examined.)

- (f.) Oysters from a point still nearer to the mainland, between the inland boundary of the bed proper and the foreshore.
(Three collected, all examined.)

- (g.) Cockles found lying exposed on foreshore close to, but not in line with, the discharging sewers.
(Six collected, five examined.)

Coming now to the result of the examination, I will indicate the fact that typical *Bacillus coli*, indicative of fæcal contamination, was detected by the sign +.

Group (a.)	.	.	.	Result +
„ (b.)	.	.	.	„ + in all.
„ (c.)	.	.	.	„ + „
„ (d.)	.	.	.	„ + „
„ (e.)	.	.	.	„ + „
„ (f.)	.	.	.	„ + „
„ (g.)	.	.	.	„ + in 2 of 5.

This result cannot be looked upon as surprising when one takes into account the proximity to the beds of sewers discharging the crudest form of untreated domestic sewage. With a view to control it, however, I procured from three establishments in Dublin, oysters alleged to come from beds on the West Coast (Clare and Galway), and subjected them to the same procedure as the Clontarf oysters had undergone. In the result the oysters obtained from two of the establishments (six were examined from each) proved to be free from *Bacillus coli*, whilst of the six obtained from the third establishment, *coli* was only detected in two of the six examined.

To what extent the presence of the *Coli bacillus* in some of this last-named batch of oysters may be ascribed to conditions of storage, is a question the solution of which I must defer till I have had an opportunity of examining authentic samples procured direct from the beds in County Galway, from which the said establishment is said to derive its supply.

The central experiment has, however, its value as showing that *Bacillus coli* is at any rate not an invariable inhabitant of oysters, and when found in specimens taken from polluted waters may reasonably be looked upon as evidence of the ingestion by the oyster or of the penetration between its shells, of matters of excremental origin.

I propose to complete my examination of the Clontarf layings by testing fresh samples of the oysters for *B. enteritidis sporogenes*, as well as the mud and water of the beds for both *B. coli* and *B. enteritidis*.

In conclusion, I beg to submit some photographs illustrating the results obtained by treating the oysters according to the method which I have adopted in this research. I may add that I have made constant use of the camera in order to have a permanent record of the often very fugitive appearances presented by the developing cultures. Reproductions of these photographs could, should the Board so desire, accompany, by way of illustration, the report when it assumes its permanent form.

I have the honour to remain, Sir,

Your obedient Servant,

E. J. McWEENEY.

The Secretary,
Local Government Board.

MEMORANDUM furnished by Dr. D. EDGAR FLINN, Medical Inspector, regarding two cases of Enteric Fever at Athlone, stated to be due to the eating of oysters.

In February, 1903, Dr. C. J. MacCormack, Medical Officer of Health, Athlone, forwarded a report to the Local Government Board of two cases of Enteric Fever that had occurred in Athlone, and had proved fatal.

Dr. MacCormack attributed both cases to the eating of oysters, and in subsequent reports (copies of which are attached), he stated that from inquiries that he had made, he ascertained that several other persons had partaken of oysters at or about the same time as the persons who had died, and they had also suffered some ill effects after having partaken of them.

Dr. MacCormack further ascertained that the oysters had been obtained from a local fish seller in Athlone, who had purchased them from a wholesale fish merchant, M. S., at Dublin. On being apprised of this fact, I made further inquiries, and was informed by M. S. that he had himself purchased these oysters from another dealer, S. D., whom I also visited, and found that he was in the habit of obtaining his supplies of oysters from K., wholesale oyster merchant at Clontarf. M. S. had purchased oysters from S. D. on December 31st, 1902, and January 19th, 1903, and consigned a portion of them on these dates to the local fish dealer at Athlone.

I subsequently visited Athlone, and Dr. MacCormack verbally corroborated the facts mentioned in his report. The local fish dealer whom I interviewed stated that he had received consignments of oysters from Dublin on the dates before mentioned, and two persons who had eaten oysters at the same time, as one of the patients, J. J. W., who died from Enteric Fever, stated to me that they also felt ill after having partaken of them, but were quite well in a day or so.

The circumstances in the cases reported by Dr. MacCormack point to the probability that the oysters may not have been in a fit or proper condition to be eaten when purchased from the local fish dealer; they came from oyster layings at Clontarf that are clearly liable to sewage contamination, and that have been unfavourably reported on by Professor McWeeney, as well as by me in a former report.

D. EDGAR FLINN.

July 4th, 1903.

COPIES of Dr. MACCORMACK'S REPORTS referred to in foregoing Memorandum.

J. J. W., who died on the 27th January, 1903, from an attack of Enteric Fever, first complained of being ill on Sunday, 11th January, 1903.

I was called to see him on the following Friday, 16th January, 1903, when I found, from the symptoms present, that I had to deal with a well-marked and, as I feared at the time, a very grave case of Enteric Fever. I had the good fortune of having the opinion of Dr. Cox, Merrion-square, Dublin, the Monday following, and he quite agreed as to my diagnosis of the disease itself and its serious character. I learned the following particulars during my attendance, and since, bearing on the probable cause of the disease:—

J. J. W. had partaken of oysters on three different occasions, namely, on the 5th, 9th, and 11th January, 1903, the last-mentioned date being the very day he fell sick.

M. O'F., High-street, Athlone, partook of oysters with J. J. W. on the 9th January, 1903, and also before Christmas.

M. McD. had eaten oysters with J. J. W. on the 11th January, 1903. He also bought three dozen of oysters for J. J. W. on the 5th January, 1903. He states that he kept half a dozen of them for himself, and found one

"quite rotten and black." The remaining five he ate without feeling any ill effects. The remaining two-and-a-half dozen J. J. W. took away with him, and in company with Rev. Mr. O'B. and Dr. K., Athlone, partook of them on the same night, 5th January, 1903. The latter states he felt very sick next morning, although he had eaten only four oysters.

T. C. partook of oysters about the same time, and he felt so sick about an hour after eating them that he swallowed a quantity of tobacco juice and promptly got rid of the contents of his stomach. He ate those oysters at the counter in H. C's. shop.

P. R. K. also bought oysters from H. C. at this particular time, and he states they seemed so bad that he ate only one or two and had the rest thrown away.

The same experience occurred to a Sergeant-Major of the Artillery stationed here at present.

All these oysters were got from H. C., Athlone, and they were sent him, as I have already informed you, by M.S., Dublin.

CHARLES J. MACCORMACK,

Medical Officer of Health.

Athlone,

14th April, 1903.

H. D., aged twenty-one years, of Leinster-terrace, Athlone, who died on the 16th February, 1903, from an attack of Enteric Fever, first complained of being ill on Friday, 23rd January, 1903. I saw him for the first time on the following Friday, 30th January, and from the marked similarity of the symptoms present to that of the previous case, who had died as already reported to the Local Government Board by me, of a most virulent type of Enteric Fever only three days previously, I at once diagnosed H. D.'s case as of an exactly similar kind. Seeing his serious condition, I suggested to the friends that I wished, without delay, that a second doctor be called in, and Dr. D., of this town, saw the case with me just three days after my first visit. He not alone agreed as to my diagnosis, but also as to the markedly grave character of the fever. The following particulars I gathered as to the probable cause of the disease. H. D. had partaken of oysters on two different occasions, namely, on the 10th January, 1903, and on the 17th January, 1903. R. C., a step-brother of the deceased, saw him eat oysters on the 10th January, he thinks about a dozen, which were sold him that very evening by a street dealer, to whom they were retailed by H. C., a local fishmonger. And, as already mentioned in my report of J. J. W.'s case to the Local Government Board, H. C. obtained them from M. S., fish merchant, Dublin. M. C. was told by H. D. himself that he had eaten fourteen oysters on the evening of Saturday, 17th January, 1903, when she met him near the Post Office, and he was actually finishing the last two when she was speaking to him, and was, she states, in the act of throwing away the empty shell of one of the two oysters just at the time. I may state that H. D. was perfectly strong and healthy up to the time of his having eaten those oysters, and I have no doubt, nor has Dr. D., that they produced his attack of Enteric Fever, the virulence of the disease being so great that the gravest symptoms were developed very early in the fever.

CHARLES J. MACCORMACK,

Medical Officer of Health.

Athlone,

1st June, 1903.

COASTS OF COUNTIES OF WICKLOW AND WEXFORD.

(Map No. 32.)

There are several natural oyster beds situate at various parts of St. George's Channel, the principal of which are, one in Brittas Bay, to the North of Mizen Head, and one in Arklow Bay, to the North of Arklow Head, both in Rathdrum Rural District, off the coast of County Wicklow. The third, Ballyvaldon Oyster Fishery, is situate off the coast of County Wexford, between Cahore Point and Blackwater Head, in the Rural Districts of Gorey and Enniscorthy. A fourth is situate off the entrance to Wexford Harbour, to the east of Raven Spit and Dogger Bank, and extending between the north and south bays.

BRITTAS BAY NATURAL OYSTER BED.

This oyster bed is situate about half a mile from the shore, in from three and a half to nine fathoms of water. It is about one mile in length by three-quarters of a mile in breadth. The bottom formation consists of shingle and sand, with debris of shells. Some years ago this bed was very productive, but for the past three years it has not been dredged. There is a fair quantity of oysters on the bed at present, but they are very large and coarse, and there is no demand for them. Very few young oysters are to be had, and the fall of spat is small. I was particularly struck by the enormous quantity of star-fish dredged up from this and other deep sea oyster beds. The star-fish is the natural enemy of the oyster, and in course of time will probably exterminate the oysters on deep sea beds.

There is no pollution of this bed.

ARKLOW BAY NATURAL OYSTER BED.

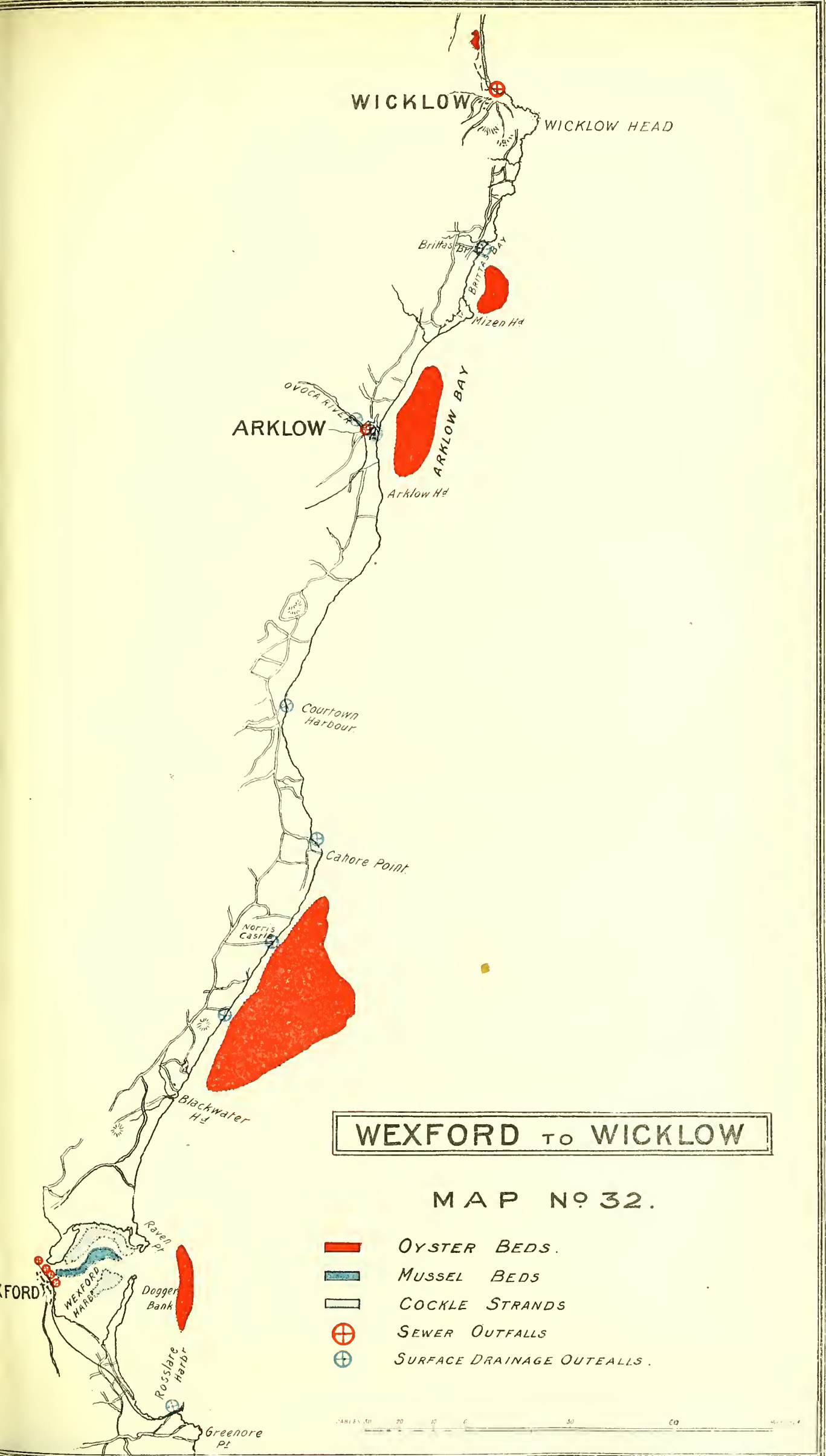
This oyster bed extends from a point opposite Johnstown, north of Arklow town, to Arklow Rock, south of Arklow. The bed is situate about half a mile from the shore, and is about four miles long by one mile broad. The bottom formation is similar to that of Brittas Bay. About thirty years ago this was a very productive oyster bed, over 100 boats being regularly employed dredging during the season. Last season only one boat was occasionally employed dredging, and no more than 1,000 oysters were taken, all of which were sold locally. The quality of the oysters is inferior, the fish being very small and the shell very large and coarse. This is explained locally as being due to the discharge of the washings from copper and sulphur mines, which is carried down over the beds to the sea by the Avoca River.

The drainage of the town of Arklow, which has a population of 4,944, is discharged into the Avoca River, and enters the bay about half a mile distant from the nearest point of the oyster bed. The town is not drained on the water carriage system, there being no water-closets, I was informed, connected with the system of sewers. There are three public conveniences on the Quay, which discharge directly into the river.

Having regard to the situation of the oyster bed in the open sea, and the small amount of excrementitious matter entering the river, I think the possibility of contamination is very slight.

BALLYVALDON NATURAL OYSTER BED.

This oyster bed is situate between Cahore Point and Blackwater Head on the coast of Wexford, in the Rural Districts of Gorey and Enniscorthy. The bed is about eight miles in length by from two to three miles in breadth, in from five to nine fathoms of water, and about half a mile distant from the shore. The bottom formation of the southern part of the bed is coarse



shingle and sand; in the northern portion it is more muddy and of a bluish tint, with debris of shells. The quantity of star-fish on the bed is enormous. For the past five years very little dredging has been done. During the past season only three or four boats dredged occasionally. The total take of oysters was under 5,000, which was sold locally in Wexford, Arklow, Enniscorthy, and other towns. The oysters are very large and coarse, and the demand for them is poor. In former years the output of oysters from this bed was very large, over 100 boats being employed in dredging operations. The oysters were sent to France and other places for breeding purposes. The fall of spat is said to be considerable, but I presume it is destroyed by natural enemies which abound on the bed, as I could not find any small oysters or young brood. I am indebted to the Fisheries Department of the Board of Agriculture and Technical Instruction for placing at my disposal the steamer *Helga* for dredging operations. There is no contamination of this oyster bed.

NATURAL OYSTER BED OFF WEXFORD HARBOUR.

This oyster bed is situate about two miles to the east of the entrance to Wexford Harbour, between the north and south Dogger Buoys, and is about three miles in length by half a mile in width in from three and a half to seven fathoms of water. The bottom formation is similar to that of the Ballyvaldon Bed. Four boats were engaged in dredging for oysters on this bed during the past season. The quantity of oysters taken was about 30,000. Twenty men were employed on the boats. The oysters are purchased by Mr. Armstrong, Main-street, Wexford, and are disposed of locally and in Dublin and Waterford, some being also sent by steamer to Bristol. Occasionally oysters are stored for three or four days in barrels in a store-room at the rear of Mr. Armstrong's premises awaiting shipment or purchasers. The oysters are, as a rule, large-sized, and plump well-flavoured fish. The fall of spat is said to be considerable. Having regard to the situation of the oyster bed and the distance from the nearest sewer outfall at Wexford (six miles), I consider that there is no risk of contamination.

WEXFORD HARBOUR.

Mussels.

Mussels are dredged from the bed of River Slaney in Wexford Harbour from a point opposite Dock Yard at Wexford to near Raven Point at the entrance of the Harbour. About twenty persons are engaged in dredging operations from October till the end of April. The quantity taken during the season would amount to about thirty tons. They are shipped direct to Bristol and Liverpool (consigned to Bevis, fish dealer, Bristol, and Balfour, Liverpool).

The sewage of Wexford is discharged in its crude state at several points along the line of Quays and within about one hundred yards of the nearest point from which mussels are dredged. The population of Wexford is 11,168, and the resulting pollution of the river is very considerable. The harbour is three miles long by four miles wide, and comprises an area of about 10,000 acres. About half of this area is exposed at low water. I think that there can be little doubt that the mussels dredged from the bed of the river near Wexford are subject to gross pollution, and those dredged further down the harbour to a lesser degree. I was informed that mussels are sometimes laid down in bags on the strand near low water mark close to the dock yard awaiting weekly shipment. The place at which the mussels are laid is quite close to the sewer outfall and liable to gross pollution.

Cockles.

Cockles are collected on the strand at low water from the eastern side of the breakwater opposite Wexford to Raven Point, and on the strand inside Ross-lare Point, at the entrance to the harbour. About fifty persons are engaged

collecting them all the year. Over 1,000 gallons are collected annually and disposed of in Wexford. As regards possible pollution, the cockles gathered on the strand nearest to Wexford would, in my opinion, be subject to contamination by the sewage effluent, and those collected from more distant places much less so if at all.

Periwinkles.

Periwinkles are collected around the coast outside Wexford Harbour. About nine tons are shipped annually to Bristol and Liverpool. They are not subject to contamination.

COAST OF COUNTY OF WATERFORD.

WATERFORD HARBOUR. (Map No. 33.)

The Harbour of Waterford is formed by the channel of the River Suir from the City of Waterford to its confluence with the River Barrow, and from thence by the joint estuary of these rivers to the sea, a distance of about eighteen miles. The harbour is two and a half miles wide at its entrance.

Cockles.

Cockles are gathered on Woodstown strand and its vicinity from April till the end of the year. About sixty persons are engaged collecting them. Over 2,000 gallons are annually collected and sold locally.

The sewage of Waterford City, which has a population of 28,153, New Ross (5,847), Carrick-on-Suir (5,400), Clonmel (10,163), Passage East (532), and also that of several other towns situate higher up these rivers, is discharged in its crude state direct into the rivers. The nearest sewer outfall to the cockle strand is that from the village of Passage East, which is about two and a half miles further up the harbour, where it is about two miles wide. Waterford City is eight miles further up the river, and New Ross is about twelve miles distant from the cockle strand. Having regard to the large expanse of water in the harbour and the distance of the cockle strand from sewer outfalls, I am of opinion that there is little risk of contamination.

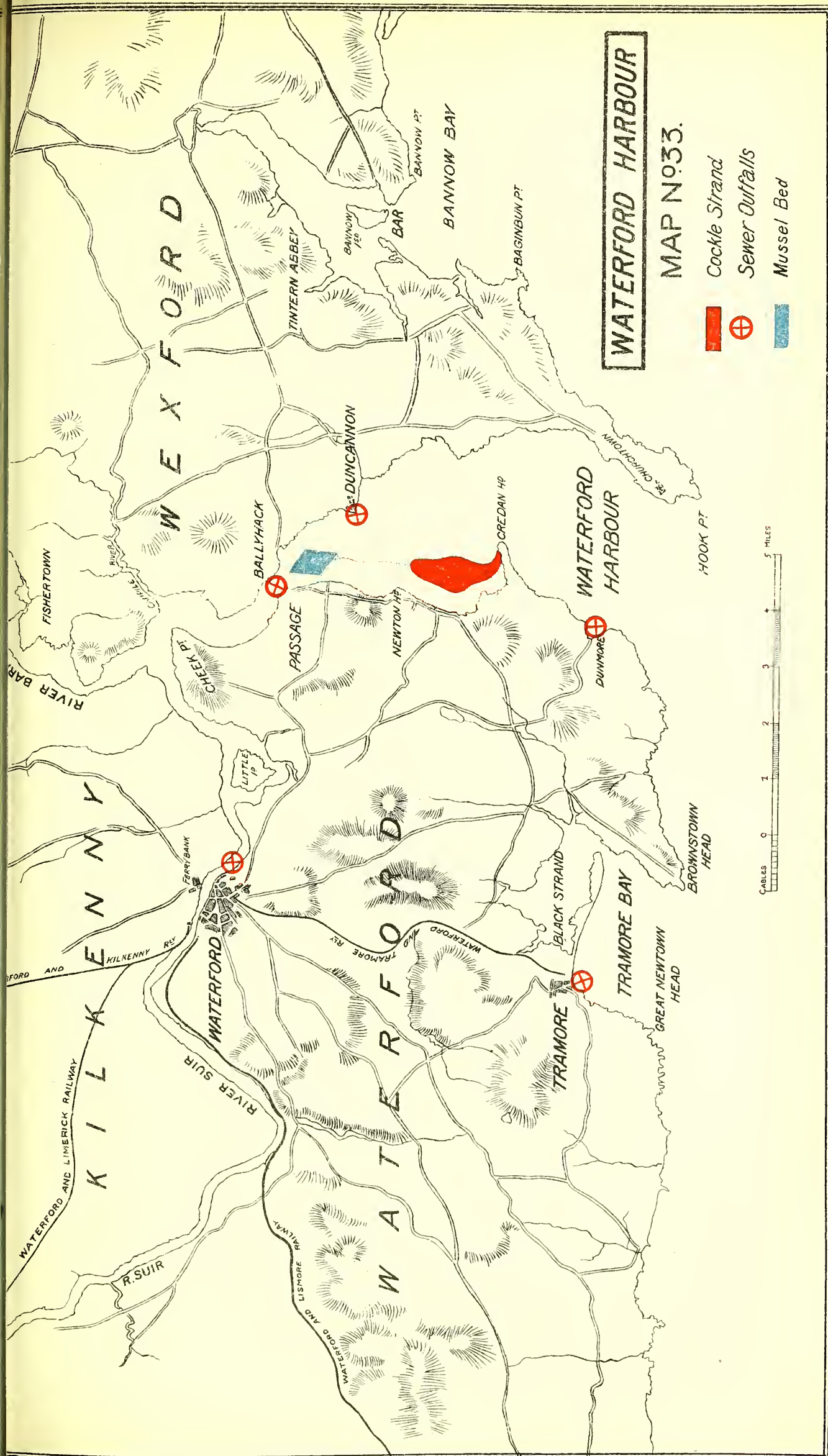
Mussels and Periwinkles.

About five tons of mussels are collected annually in Waterford Harbour, and about the same quantity of periwinkles. The mussels are sent off by steamer to Liverpool and Manchester, and the periwinkles to Liverpool and Bristol, packed in bags.

As regards the liability of the beds to pollution, the observations made above respecting cockles apply also to mussels and periwinkles from Waterford Harbour.

T. J. BROWNE.

August, 1903.



WATERFORD HARBOUR

MAP No. 33.

- Cockle Strand
- Sewer Outfalls
- Mussel Bed



REPORT

ON THE

BACTERIOSCOPIC EXAMINATION OF SAMPLES TAKEN FROM
SHELL-FISH LAYINGS,

BY

PROFESSOR E. J. McWEENEY, M.A., M.D., D.P.H.,

Bacteriologist to the Local Government Board for Ireland.

REPORT OF BACTERIOLOGIST.

General Observations as to Methods of Examination.

The *material examined* comprised shell-fish, water, and mud or sand from the several layings. In the majority of cases the shell-fish were oysters; less frequently mussels and cockles were sent. During the earlier stages of the investigation, when for any reason it seemed advisable to curtail the number of specimens, this was usually done at the expense of the mussels, as I was under the impression that these molluscs were always eaten in the cooked state, and that consequently the possibility of their contamination with sewage was of little hygienic importance. From information that came subsequently to hand, I became convinced that this was far from being the case, and that mussels are, as a matter of fact, not unfrequently consumed in the raw state. During the later stages of the Inquiry, I therefore never failed to examine a fair proportion of the mussels when such were sent on, together with oysters and cockles, from any locality. Periwinkles are, I believe, never eaten uncooked, and accordingly I excluded these molluscs from the investigation.

The specimens were usually selected by Dr. Browne at the time of his visit, and sent packed with seaweed in cardboard boxes. They generally reached me on the morning after collection.

The specimen of water was taken usually at low tide by Dr. Browne in a sterilised, glass-stoppered, 8-ounce bottle. The mud or sand was scraped from the surface of the laying or sand-bank and sent in a wide-mouthed corked bottle of about 4 ounces capacity.

In a large number of cases I was enabled to carry out the preliminary stages of the examination on the day the samples came to hand. When, for any reason, this could not be done, the parcels were kept unopened in the ice-chest. In not more than half-a-dozen cases did the delay amount to more than three days, and the finding of a dead or even dying oyster or mussel in any batch of samples was a rare occurrence. The cockles appeared to be less tenacious of life, and, when more than a day had elapsed since their arrival, a considerable proportion were usually found to have opened.

The number of specimens examined from each laying did not vary within wide limits. I considered six molluscs, together with sand and water from each locality as the standard quantity, and adhered to it so far as the number of specimens sent, and the store of sterile substrata in readiness would permit. Before I became fully conscious of the magnitude of the task I was engaged on, I found myself, owing to lack of substrata, compelled, on more than one occasion, to limit the number of specimens examined from each laying to a greater extent than now seems advisable. This applies especially to certain layings in the Cork, Clare, and Galway regions. Later on, however, I made such arrangements as enabled me to cope with the standard amount of material in every case in which it came to hand, and I look forward to completing the results wherever they appear based on an insufficient number of samples. This supplementary examination will take the form of an appendix to the present report.

The object of the examination was, of course, to endeavour to determine by bacteriological methods the presence or absence of sewage contamination. In my earliest work I proceeded by means of gelatine plate-cultures made with known standard quantities of material, and by the Parietti method for the demonstration of *Bacillus coli*. The object of the plate-cultures was to enable me to form some idea of the normal bacterial content of the molluscs both as regards number and character of germs. There was also the possibility that departures from such normal content might appear on the gelatine plates, and might be susceptible of interpretation as evidence of sewage contamination. These expectations were, however, disappointed. The germ-content of the molluscs was found to be extremely variable, the nature of the germs present in many cases (*viz.*, rapidly liquefying the gelatine) was antagonistic to prolonged observation of the plates, and the task of identifying the colonies and constructing a bacterial flora of the three species of mollusc, was utterly beyond my resources of time and available working-power. By way of illustration I subjoin some photographs

of plate-cultures showing the wide differences (a) in quantitative and (b) in qualitative germ-content between consecutively examined oysters from the same source. [Plate I., figs. 1, 2, and 3.]

Accordingly I resolved in the first place to apply myself to the demonstration of the organism universally admitted to be the characteristic constituent of the bacterial flora of sewage, *Bacillus coli communis*, and in the second place to extend my observations to those organisms—viz., *Bacillus enteritidis sporogenes* (Klein) and *Streptococci* (Houston)—which have been suggested as test-organisms in this connection, but the value of which as such appeared to me at the inception of this investigation—and I may be permitted to add, does still appear to me—very problematical.

The investigation to which I subjected the material comprises the systematic search for *B. coli communis* and *B. enteritidis sporogenes*; with regard to *Streptococci*, I have not systematically sought for them, but have contented myself with recording their occurrence when I had occasion to observe it in broth tubes or on gelatine plates.

Method of Working.—Conceiving as I do, that, to be of practical value, the results of hygienic inquiries of this kind must be based on methods not too widely different from those of every-day practice, I took no special precaution to sterilise the exterior of the oysters, &c. They were merely brushed free from mud under the tap, well rinsed with water, and opened by myself “on the flat shell.” Great care was, however, taken that the instruments used were sterile, so that there could be no possibility of the conveyance of material from one mollusc to another. A large number of oyster-knives and pipettes were used for each batch, and each instrument was carefully re-sterilised in the steamer before being used a second time. The shells of the oyster having been separated, the juice of the animal was allowed to flow from the flat shell on which it lay into the concave shell, and the yield was increased by making a crucial incision through the body of the mollusc with a fresh sterile knife, and, when necessary, accelerating the flow of juice by gentle pressure with the flat of the knife. From the contents of the concave shell, consisting of a mixture of sea-water and body-fluid, one cubic centimetre was taken up in a sterile pipette and transferred to a ten cubic centimetre tube of sterile peptone-broth, and another cubic centimetre to a tube containing ten or more cubic centimetres of freshly sterilised whole-milk. Not unfrequently the oysters were large and yielded an abundance of shell-water and body fluid, and in these cases larger quantities—up to three c.c.—were used for inseminating the tubes. These cases are noted in the tabulated statements. On the other hand the oysters were occasionally dry, and the small quantity of liquid available for insemination was then supplemented with a block of tissue cut from the animal itself so as to include portion of the alimentary canal. Several pairs of sterile scissors and forceps were always at hand for this purpose. It will be observed that the *same* oyster was, as a rule, used for the two tests. This I regard as a point of some value as throwing light upon the co-existence, or the reverse, of the two organisms sought for, in material the homogeneity of which was unquestionable. No *two* oysters can be regarded as homogeneous, but the mingled juice and shell-water of the *same* oyster may, I think, be fairly regarded as such.

In the case of mussels there was usually an abundance of clear water between the shells and no attempt was made to enrich it with body-juice, as the collection of the liquid had to be quickly accomplished. Occasionally it was necessary to snip out the alimentary canal and introduce parts of it into the two culture tubes, and this had usually to be done in the case of cockles in order to provide the amount of material considered necessary.

The procedure adopted with the water was at first very simple. After shaking the bottle well, one c.c. was removed to each culture tube with a sterile pipette, and this procedure was adhered to all through when testing for *B. enteritidis sporogenes*. On the other hand, it seemed advisable in the case of *B. coli* to make some attempt to ascertain whether the demonstration might not be oftener accomplished by using larger quantities, and I accordingly adopted the plan of pipetting off fifty c.c. of the sample into a flask containing fifty c.c. sterilised distilled water, rendered nutrient by addition of ten c.c. of a strong lactose-peptone solution

and tinged blue with litmus. The object of the admixture with distilled water was, of course, to diminish the saline strength of the liquid which—especially at 37°—might have been prejudicial to the growth of *B. coli*. I adopted this “flask-method” rather than stone-filtration because my laboratory resources did not admit of the use of such numbers of Berkefeld-filter arrangements as were required to cope with the samples. I found it to work quite satisfactorily.

My practice as regards the mud or sand progressed on similar lines. At first I used three large loopfuls for both *Coli* and *Enteritidis* tubes. Subsequently I used rather more—sufficient to cover the point of the blade of a scalpel. When I adopted the flask-method for the water I applied it to the mud also, rinsing out the whole contents of the sample bottle into a wide-mouthed Erlenmeyer-flask with sterile distilled water, bringing to 100 c.c. and rendering nutrient as above described. For the demonstration of *Enteritidis* in mud the smaller quantity was adhered to, nor was it necessary to diverge from it, as the result was almost invariably positive.

In the test for *B. coli* the further procedure was as follows:—At first I used to add 9 drops of Parietti's solution (hydrochloric acid 4, phenol 5, water 100), but subsequently I simplified this by adding from a sterile burette 0.3 c.c. freshly made and boiled watery solution of pure crystallised phenol (strength 5 per cent.). To the 100 c.c. flasks 3 c.c. phenol were added. The tubes or flasks were incubated at 37° for twenty-four hours and then examined. They were first divided into three batches, viz., those that displayed a turbidity of undoubtedly bacterial origin, those the turbidity of which might be due to the material introduced, and those that remained quite clear. The last batch was returned to the incubator for another day. The second batch was examined in the hanging drop, and those that showed bacteria were placed with the first batch, the others with the last. The first batch was then plated out in ordinary gelatine after suitable dilution to avoid overcrowding of colonies. In order to economise Petri dishes, I made use of Esmarch roll-tubes very largely at first, and subsequently I adopted the plan of ruling the bottom of the Petri dish into four quadrants, pouring in the sterile gelatine and letting it “set,” and then inoculating the surface of each quadrant with a loopful or two of the dilute contents of a phenol-broth tube by means of a small sterile camel's hair brush. I found this plan the quickest and most economical of all, and can recommend it. Instead of quadrants the Petri dish may be divided into eight segments. The one gelatine tube and Petri dish can thus be made to suffice for eight analyses.

In the flask method such of the vessels as showed change of colour from purple or blue to red, or which became decolourised, were similarly plated out. The cause of the change of colour is the fermentation of the lactose, with formation of lactic acid which reddens the litmus. Many strains of *Coli* go further, and reduce the litmus to a colourless leuko-product. The use of the phenol would appear to be to keep down the growth of *Proteus* and other liquefying germs, and I am convinced that it really does this. On the other hand its presence may, when the material used is very poor in *Coli*, render the method somewhat less delicate by interfering with the development of that organism. Its omission, however, tends to favour the occurrence of *pseudo-Coli* species, a point which will be referred to later on.

The tubes that had not showed development at the end of twenty-four hours were re-examined at the end of two days, and such as contained bacteria plated out. Incubation was not pushed further, as experience showed that in 90 per cent. of the cases *Coli* developed within twenty-four hours and in the remaining 10 per cent. within forty-eight, or not at all.

The plates were kept at 21° C. and examined daily. At this temperature *Coli* grows very rapidly, and the colonies are quite recognisable in twenty-four hours. Unless, however, the concurrence of liquefying germs threatened to destroy the plate they were not subcultured till the second or third day. After subculture the plates were generally photographed.

The method above described is in reality one of *enrichment*, forcing on by artificial methods the reproduction of a relatively small number of *Coli*-germs originally present, so that at the end of twenty-four hours the culture fluid comes to contain that species in overwhelming proportion. Its value

may best be appreciated by glancing at the figures [Plate I., figs. 1-4], showing the appearance of plate-cultures made direct from suspected material, and comparing them with the plates made after enrichment in phenol-broth [Plate I., figs. 6-9]. In the former case we see the plate covered with most diverse colonies in large numbers, amongst which those of *B. coli* are discoverable with difficulty even using a powerful hand-lens. Furthermore the rapid development of the liquefying colonies destroys the plate [Plate I., fig. 5], before the *Coli* colonies can attain their characteristic appearance. On the other hand, the plates made by surface brushing after enrichment and appropriate dilution show little else but *Coli* colonies which have ample space to attain their full size, and assume their well-known appearance. Did we possess a similar enrichment method for the Typhoid Bacillus, many questions in the epidemiology of that disease that are still obscure would long since have been elucidated.

Characteristic as the appearance of *B. coli* on gelatine plates undoubtedly is, there can be no question as to the necessity of always verifying the diagnosis "genuine *Coli*" by the appropriate tests. These tests have been variously stated by various writers, and by many have, I think, been inadequately characterised. I wish to lay special stress upon the absolute necessity that every writer who concerns himself with *Bacillus coli* should explicitly state all the characters upon which he relies when he gives that name to a given culture. Through the neglect of this precaution much of the work that has been done upon the distribution of this organism in nature has lost its value.

The characters of every coli-form organism isolated in the course of this investigation have been studied under the following heads:—

1. Motility ;
2. Behaviour to Gram's method ;
3. Appearance of the colonies on gelatine plates ;
4. Power of fermenting carbohydrates ;
5. Power of coagulating milk ;
6. Growth on potato ;
7. Power of reducing certain colouring matters ; and
8. Formation of indol.

It will be necessary to say a few words on each of these points.

1. In most books the statement will be found that *B. coli* is a feebly motile organism. This does not always hold good. From fæces both of suckling babies and of adults I have obtained colonies of coli-form appearance that consisted of extremely active organisms, and were "typical" in all other respects. Furthermore, I have isolated, direct from fæces, colonies of otherwise typical *Coli*, the individuals of which were quite stiff, seemed spaced-out or isolated from each other in the hanging-drop, so as to lead the observer to infer the existence of an abundant mucoid sheath round each, and were perfectly motionless. I have also observed cases where the organisms were motile when grown at 18° to 21° and motionless at 37°. Many other workers have had similar experiences, *e. gr.* Stöcklin,* who isolated 300 strains of *Coli* from normal fæces, and found 184 to be more or less actively motile, whilst the other 116 were motionless. The presence or absence of motility cannot, therefore, serve as a test to distinguish genuine from *pseudo-Coli*.

2. None of the strains isolated retained the stain by Gram's method, and as this non-retention is common to all the *Bacilli* of the *Coli* group it cannot be used to differentiate *Coli sensu stricto* from pseudo-forms.

3. On gelatine plates two forms of *Coli* occur: the commoner, thin, vine-leaf or filmy form, and the thick, opaque, discoid form. The former usually consists of short actively motile, the latter, of longer, motionless, stiff-looking individuals. I have usually termed this the *aerogenes* form, on account of its resemblance to, or perhaps identity with, Escherich's *Bacillus lactis aerogenes*, isolated from suckling-fæces. Both forms occurred very generally in material which might be regarded as heavily infected with *Coli*, and a colony of each kind was always subcultured and put through the tests, the result

* Stöcklin, 'Recherches sur la mobilité et les Cils du Groupe des Coli-Bacilles. (Annales suisses des Sciences Medicales, Berne, 1894.)

being that no constant difference could be found between the two varieties save the above-mentioned ones—appearance of the gelatine colonies and motility. The *Colon Bacillus* never liquefies the gelatine, and two strains which complied with the other tests, but which slowly liquefied the gelatine, had to be excluded. Similar strains have been obtained by other workers, and received special names. I have frequently had occasion to observe the production of opacity and of masses of small crystals (of ammonio-magnesian phosphate) in the gelatine; but do not regard these appearances as sufficiently constant to serve as a basis for the separation of true *Coli* from the outlying varieties.

4. The power of fermenting carbo-hydrates is an essential part of the biology of this organism. All the strains which I studied *ad hoc* fermented glucose and maltose. Most of them fermented saccharose* also, though not so vigorously. In accordance with the general practice I have made lactose the test-substance, using it in the form of one per cent. solution in agar tinted blue with litmus. The strain under examination must evolve an abundance of gas and acid when sown as a shake culture in this *litmus-lactose-agar*. The medium must be split up by the evolution of gas, and its original blue colour must be turned to red or discharged altogether by reduction. If these changes do not occur the organism is not classed as “genuine” *Coli*.

This would appear to be the proper place to refer to the evolution of gas bubbles in ordinary, *i.e.*, non-sugared gelatine shake-culture, which is looked upon by some as a test for genuine *Coli*. My experience is that a great many strains isolated direct from fæces do not give this “bubbling,” or produce only a very few minute gas bubbles in un-sugared gelatine. At first sight the “bubbling” might appear to depend merely on the accidental presence of a small amount of fermentable carbo-hydrate (muscle-sugar) derived from the meat used in preparing the substratum. But the matter is not quite so simple. Lepierre† found that the gas evolution occurred in absolutely carbo-hydrate-free gelatine, and that the evolved gases consisted of a mixture of one part of free H with two of free N (instead of CO₂ and H, as would be the case were they derived from carbo-hydrate fermentation). This curious phenomenon would appear, therefore, to depend on either (1) a more vigorous and complete destruction of the proteid molecule than the general behaviour of *B. coli* towards proteids would lead us to expect; or (2) the existence in the gelatine, peptone or common salt used in making the medium, of traces of nitric acid, which is reduced by the *Bacillus* to nitrous acid. This may then undergo further reduction to free N, or may act upon amides or amido-acids with evolution of that gas.

Whatever be the significance of the “bubbling” to which *Coli* does undoubtedly sometimes give rise in genuinely carbo-hydrate-free gelatine shake-culture, my experience leads me to state that it is not of sufficiently regular occurrence to justify its employment as a test-reaction. The preparation of the medium is, furthermore, a source of difficulty and delay. On the other hand, if the bubbling be due to traces of carbo-hydrate in the medium, the proper course to take would undoubtedly be to regularise the presence of these traces by adding a definite quantity during the preparation of the medium. This I have done throughout the whole of the work, testing each batch of *Coli*-form organisms in shake-culture on (1) ordinary, and (2) $\frac{1}{2}$ per cent. glucose gelatine. The conclusion I have come to is that the occurrence of bubbling in No. 1 is too capricious and uncertain, and in No. 2 is too invariable to be of use. By requiring bubbling to occur in ordinary gelatine, we should exclude many strains that are perfectly typical in other respects. By including all that bubble glucose-gelatine we should include a great number of strains that are in other respects (*e. gr.*, effect on lactose, on milk, indol-formation) quite outside the denomination “genuine.” For these reasons I do not place the “bubbling” of gelatine cultures in the category of essential tests, compliance with which must be insisted on.

* A comparative study of 16 coli-form strains undertaken at my instance by my former pupil W. MacCarthy, Esq., M.B. [Travelling Scholar in Pathology of the Royal University], revealed the fact that all save one fermented saccharose broth with gas evolution varying from 44 to 2 mm. in the fermentation tube. The broth had been previously freed from carbo-hydrate by Smith's method, and contained 2% of saccharose.

† Sur les gaz produits par le Colibacille. Comptes rendus de la Soc. de biologie, 1898.

5. The power of coagulating milk possessed by genuine strains of *B. coli* would appear to be due to acid-fermentation of the lactose. This character therefore agrees with that stated in the last paragraph as regards the behaviour of the genuine *Bacillus* in lactose media. The coagulation must be complete, and after a few days the clot must be firm, more or less contracted, and surrounded by a clear whey. If after four days at 37° coagulation have not occurred, I do not feel justified in considering the organism to be genuine.

6. The manner in which many of these strains grew on this medium was very variable, many otherwise typical approximating to the colourless aspect of typhoid when grown on potato. In common with others who have worked on this subject I have come to the conclusion that the character of the potato used has quite as much to do with the appearance of the culture as the character of the *Bacillus*, and I have not, therefore, rejected any organism which was otherwise typical, on account of its behaviour on this medium.

7. The powerful reducing effect of *Coli* on litmus is one of the most familiar properties of that organism. It extends to other colouring matters as well (methylene blue, sulphindigotate of soda); but the most striking changes would appear to be produced when neutral-red is used. This colouring matter, which was first introduced into Bacteriology by Rothberger in 1898, has the advantage of exhibiting not merely reduction, but a superadded phenomenon, that of fluorescence, when acted upon by the *Colon Bacillus*. As I have never met with an otherwise typical strain isolated directly from fæces which did not comply with this test, I have made it an essential one, and required compliance with it from all strains isolated in this investigation before classing them as genuine *Coli*. At the same time I would not suggest that some coli-like microbes responding feebly to this test, may not, if typical in other respects, be significant of objectionable pollution. I have always used agar-shake-cultures, tinged with neutral-red. By this method gas is not unfrequently evolved as well. I cannot however agree with the suggestion of those who would use this test for the recognition of *B. coli* in *bacterial mixtures*.* Although, according to my experience, genuine *B. coli* always produces the change, other organisms do so as well. I do not wish to be taken as denying all value to the test when applied *directly* to water or the like, but for the present at least I should not feel inclined to rely upon indications yielded by neutral-red substrata unless applied to (or supported by) pure cultivations.

8. The formation of indol in liquid media containing "peptone" is, perhaps, the best evidence we possess of the ability of the *Colon Bacillus* to attack Proteoses if not Proteids. The reaction for indol is a delicate one, and its success depends on the kind of culture used and the way in which the test is applied. I have always used ordinary Witte-peptone-broth cultures inoculated from the original gelatine-plate-colonies obtained when the organism was first isolated. The broth cultures were always incubated for two days at 37° and then allowed to stand at room temperature for three weeks or a month. They were then tested with half their volume of a 20 per cent. solution of pure sulphuric acid (run in from a burette) and placed in the water-bath at 60° for five minutes to see whether the pink coloration would come on, in which case the organism would appear to have formed nitrite as well as indol (assuming, of course, the Witte-peptone and H_2SO_4 to be free from nitrites). This actually did happen in about ten per cent. of the strains, though the amount of nitrite was never large enough to produce more than a faint rose tinge. After the lapse of five minutes at 60° C., from 1 drop to $\frac{1}{2}$ c.c. of a 0.02 per cent. solution of potassium nitrite was run in from a burette into the warm liquid. The effect was usually marked. An exquisitely delicate pink hue at once pervaded the fluids or formed a disc at their junction if they were not allowed to mix, and quickly deepened to an intense reddish purple. I had never seen such profound indol reactions until I adopted the above method of applying the test. Otherwise typical strains always gave

* Cf. Makgill on the "Neutral-Red Reaction as a means of detecting *Bacillus Coli* in Water-Supplies": Savage on "Neutral-Red in the Routine Bacteriological Examination of Water." Jour. of Hygiene, Vol. I., No. 4.

the reaction to perfection, whilst it was often missed in otherwise atypical ones. Compliance with this test I have always insisted on as a fundamental character of genuine *B. coli*.

To sum up: the characters on the strength of which I have regarded a strain of coli-form character as genuine *Coli*, are the following:—

- (a.) Character of gelatine colony and non-liquefaction of that medium even after a long time.
- (b.) Non-retention of the stain by Gram's method.
- (c.) Fermentation of lactose with formation of gas and acid.
- (d.) Coagulation of milk within 4 days at 37°.
- (e.) Production of yellowish-green fluorescence in neutral-red-agar-shake-culture.
- (f.) Production of indol in liquid peptone-media.

The accessory tests to which I have subjected all cultures, but on the result of which I do not lay principal stress, are:

- (g.) "Bubbling" of "ordinary" and glucose-gelatine-shake-cultures.
- (h.) Growth on potato.

Lastly, on the motility of individuals, or its absence, I hesitate to lay much stress.

In conclusion, I may say that I saw no advantage from studying the pathogenicity of the very numerous strains isolated. In the case of genuine *B. coli* this character admittedly varies within wide limits. Nor did it seem advisable to undertake the colossal task of studying the serum-reactions, more especially in view of the doubtful and contradictory results arrived at by others.

With regard to the occurrence of *pseudo-Coli* organisms, I have not found them of such frequent occurrence as I originally anticipated. They seemed to occur more especially in connection with certain enrichment methods. One example of this may suffice. Five oysters sent by Dr. Browne from the Public Beds, Tralee, were tested by three several methods, viz.:—

- (1.) The method of M'Conkey—culture in litmus-glucose-bile-salt-broth, with fermentation tube;
- (2.) The method suggested by Klein (*British Medical Journal*, Feb. 21, 1903)—culture in litmus-lactose-peptone water, with fermentation tube; and
- (3.) The phenol-broth method as described above.

The fluid contents of each oyster were divided into three parts, one of which was added to a culture tube of each of the above substrata. The result was that all five oysters gave gas and acid in the Klein and M'Conkey tubes, whilst only one (No. 3) gave rise to development in the phenol-broth. All were plated out, and yielded coli-form colonies more or less mixed with liquefying ones, save in the case of the phenol-broth tube, which yielded coli-form colonies in a state of purity.

On further testing it was found that the coli-form organisms obtained from oysters 1, 2, 4, and 5 by the two fermentation-tube methods failed to react typically in litmus-lactose-agar, neutral-red-agar, and milk, and were besides very weak formers of indol. They belonged, therefore, to the category of *pseudo-Coli* organisms. The coli-form organisms obtained by the phenol-broth method from oyster 3 proved to be genuine. [See photographs, Plate VI., figs. 4, 5, 6.]

The phenol-broth is thus shown to have singled out one oyster, and justly so, whilst the seemingly positive results obtained in the case of the other four by the fermentation tube methods proved on examination to be due to organisms, the genuine character of which seems at any rate open to question, and which certainly lie outside of the—perhaps somewhat arbitrary—limits which I have ventured to draw.

Turning now to the demonstration of *B. enteritidis sporogenes*. I proceeded at first strictly along the lines laid down by Klein, the discoverer of that organism, my only departure from his method being in the direction of more complete anaerobiosis. After addition of the standard quantity of material to freshly-sterilised litmus-milk the tubes were heated in a

water-bath to 80° for ten minutes, and then placed in a large Novy's bottle, the air got rid of with H₂, connection with the atmosphere cut off, and the anaerobiosis tested by spilling a little caustic alkali on the bottom of the vessel which was strewn with pyrogallol. After two or three days' incubation the tubes were taken out and the contents of those that seemed typically changed were tested by microscopic examination and injection into animals. Furthermore, by means of dilute stroke cultures on oblique sulphindigotate-agar in a Novy bottle under H₂ and over pyrogallol, as well as by glucose-agar plates in a Bulloch's apparatus, the organisms producing the "typical" change were isolated and their principal characters investigated. As the result of this work I find myself in agreement with Klein as regards the following points:—Large size, tendency to chain formation, bluntly-rounded ends, Gram-stainability, and variable motility of the organism; its tendency not to form spores in milk-culture; its capacity for liquefying blood-serum (I used Löffler's), whilst it forms an abundance of spores in that medium; its power of slowly liquefying gelatine, with ultimate formation of a clear liquid, at the bottom of which are thick white flocculi, and at the top imprisoned gas-bubbles; and its effects on guinea-pigs, which I have tested again and again with results identical with those recorded by Klein. On the other hand, I have *not* found it necessary to adopt anaerobic methods in order to obtain the typical *Enteritidis* change in milk. In confirmation of this statement I submit photographs [Plate VI. figs. 2 and 3] showing duplicate milk-tubes inoculated with the same amount of material from the same cockle, and incubated one under aerobic, the other under anaerobic conditions for the same length of time. A glance at the illustrations will show that the typical change has supervened quite as often under aerobic as under anaerobic conditions. Furthermore, the contents of certain of the aerobic tubes that showed the typical change were contrasted as regards their pathogenicity for guinea-pigs and found to be fully equal in this respect to the milk-cultures made in the absence of air. The explanation of the growth of this obligate anaerobe without special precaution is the existence of a layer of cream on the surface of the sterile whole-milk. When skim-milk was used comparatively few of the tubes show the typical change. Provided, then, that fairly rich whole-milk be used, I can see no advantage in adopting anaerobic methods for the demonstration of this organism, and the greater part of my results are based on the result of incubating the inoculated milk tubes without special precaution. Possibly those who advocate the test have observed the same facts, but hesitate to abandon anaerobic methods, lest by doing so some unsuspected error might arise.

I very much doubt the significance of the presence of *B. enteritidis*. Even when the milk-tubes failed to display the change designated as typical by Klein, microscopic examination has repeatedly shown me the presence of a minority of anthrax-like, Gram-staining, non-sporing rods, evidently *Enteritidis*, but *Enteritidis* which had failed to get the upper hand owing to the prevalence of some other obligate or facultative anaerobic competitor. I have been obliged to conclude that *Enteritidis* is a very frequent denizen of molluscs and the sandy mud in or on which they dwell—with the exception of deep-sea beds (*cf.* Wicklow and Wexford results). It appears to me to be one of a number of anaerobic saprophytes, normally occurring in putrescent organic matter, whether of animal or vegetable origin.—(*cf.* Balfour Stewart's results with corn. Reports of Thomson Yates' Laboratories, vol. III., pt. I.).

Its mere demonstration would not, therefore, appear to afford convincing evidence of *fecal* contamination. On the other hand its absence may be allowed to have a certain negative value, inasmuch as, owing to its great frequency in *faeces*, it could hardly be absent from material contaminated to any appreciable extent with sewage. Looking at the whole subject from the broad standpoint of the general biologist, we see that the great processes of carbon- and nitrogen-circulation in nature are carried on through the agency of saprophytic organisms, mainly bacteria, some of which are anaerobic. These anaerobes may fairly be expected to occur wherever there is organic matter undergoing decomposition, that is, practically everywhere. The fact that some of them, through their toxins or otherwise, are capable of producing disease in animals into which they fortuitously obtain access, is a mere accident. The demonstration of potential pathogenicity, such as that afforded by Klein

in the case of his *B. enteritidis sporogenes*, is no proof that the organism habitually acts in that way, or is in any sense closely or indissolubly connected with human life-processes. Like Tetanus it is an anaerobic saprophyte with a rôle of its own to play in nature, though what that rôle is we do not as yet know. Like Tetanus it possesses organs of persistence (spores), which enable it to indefinitely survive any fortuitous connection it may have had with the human organism, and more especially to outlive the delicate non-sporing organisms, such as typhoid and *Coli*, which have undergone special differentiations to enable them to survive in the human body, and to play their part—hostile in the case of the one, defensive in that of the other—in its life processes. The fact that these anaerobes form spores is therefore an important reason why they should not be used as a test of the hygienic quality of an article of diet.

How different is the case with *Coli*. Here we have an organism devoid of spores, and therefore endowed with very limited powers of persistence—an organism which is a habitual denizen of the alimentary canal of men and animals, and enormous numbers of which—thousands of millions of individuals—are daily produced by every human being and higher animal; an organism which has a most important rôle to play in connection with the digestive processes of the animals with which it is symbiotic—the prevention of putrefactive changes in the alimentary canal (Bienstock).^{*} When our object is to test whether a given article of diet is contaminated with such discharges, and therefore potentially with the pathogenic forms of bacteria (typhoid, cholera) which they may contain, it is clearly to the *Colon Bacillus* we must look as the unmistakable index of such contamination. If we find this *Bacillus* present in large numbers we are justified in inferring that the contamination has been recent in point of date and *faecal* in character. If the contamination has been of such old standing that the demonstration of the *Colon Bacillus* fails, then the more delicate pathogenic forms will *a fortiori* have also died out, and the material may be regarded with high probability as hygienically unobjectionable. If we do not find *Coli*, but do find the spores of *B. enteritidis* or other saprophyte, it is difficult to see what precise inference we can draw as to the existence or non-existence of faecal contamination. Accordingly, while not disposed to differ from those whose experience of the test is wider and more varied than mine, to the extent of denying to it all value in hygienic investigations, I cannot, in the light of my present experience, assign to it a value even approximately equal to that of the test for *B. Coli communis*.

The gravest objection to the evidence of sewage contamination based on the bacterioscopic test is undoubtedly the ubiquity of *B. coli*. The fact that it invariably appears in the alimentary canal within a few hours of birth is a proof of this ubiquity, and the fact that so many billions are daily liberated from the alimentary canal of men and animals serves to explain it. Can we fairly base conclusions on the presence of so widely distributed an organism? My opinion is that we can, provided that we do not base them on the mere presence or absence, but upon the degree of concentration of the *Colon Bacillus*, as was, I believe, first pointed out by Houston. Fæces afford an example of *Colon bacilli* aggregated in the closest manner met with in nature. And from this degree of aggregation downwards every intermediate state of concentration probably exists down to that met with in a public water supply, one or two litres of which can only supply a single *Colon* germ. If we can establish in the case of each article of food liable to sewage contamination, a maximum standard of *Coli*-content—as has been so brilliantly attempted by Houston in the case of sewage effluents—we shall have done all that can fairly be demanded of bacteriology, unless indeed further researches show that fæces contain some still more characteristic organism (such as *B. acidophilus* recently found by Morof in the fæces of sucklings), which is not liable to occur elsewhere.

^{*} "Untersuchungen über die Ätiologie der Eiweissfäulniss."—*Arch. f. Hyg.*, 1900. "Du Rôle des Bactéries de l'Intestin."—*Annales Pasteur*, 1900.

† Jahrb. f. Kinderheilk., 1900.

The question arises whether the work which I have now the honour to submit to the Local Government Board does really supply such a standard. Confident as I am of its accuracy, so far as it goes, I am not prepared to assert that it does this. It tells of the presence or absence of the *Colon Bacillus* in 1 c.c. of oyster contents; it tends to show that the *Bacillus* is absent from 1 c.c. of fluid when the oyster comes from uncontaminated sources, and that when the *Bacillus* is present in several oysters from the same source, that source is usually open to grave suspicion on other grounds. In order to thoroughly solve the problem it would be necessary—

- (1.) To ascertain whether oysters, &c., which do not contain the *Colon Bacillus* in 1 c.c. can be shown to contain it in their entire organism;
- (2.) Whether the *Colon-Bacillus* is ever demonstrable in small quantities (1, 10, or 100 c.c.) of sea-water taken far from the shore, and therefore absolutely free from all possibility of contamination with sewage; and
- (3.) Whether there exist in the sea-water of oyster-beds sources of *B. Coli* (*sensu stricto*) other than sewage. I refer to the possibility that the intestinal contents of sea-fowl and fish may contain that organism, and, under certain circumstances, liberate it into the water in quantities large enough to perceptibly affect its bacteriological character.

If oysters that do not contain *B. Coli* in 1 c.c. juice are found free from it altogether, then there can be no doubt that this amount will really form a convenient standard quantity from which the *Colon Bacillus* must be absent in hygienically unobjectionable molluscs.

If it can be shown that the *Colon Bacillus* does not occur in, say 100 c.c. of open sea-water, then its occurrence in, say 1 c.c. of water from an oyster bed, must surely be held to justify condemnation of that water as contaminated with *Colon-Bacillus*-containing-material—in other words with sewage—provided that the other possible sources of *Coli*, referred to in paragraph 3 above, are shown to be practically non-existent.

It is to these points that I propose to turn my attention in any subsequent work which the Local Government Board may see fit to entrust to me on this subject.

In conclusion, I would draw attention to the fact that in preparing the bacterioscopic reports which I have now the honour to submit, I have been not only uninfluenced by any local knowledge, but—with the exception of Dublin Bay and vicinity—absolutely ignorant of the local conditions. With the results of Dr. Browne's inspection of the several localities I have never become acquainted till after the bacterioscopic report was completed and sent in. I cannot but regard it as highly satisfactory, from the point of view of Bacteriology, that the conclusions arrived at by Drs. Browne and Edgar Flinn, Medical Inspectors to the Local Government Board, as the result of examination of the several localities, have in so many cases been in agreement with the results to which I have been led by independent laboratory investigation.

DETAILED REPORTS OF RESULTS OF EXAMINATIONS.

COAST OF COUNTY OF CORK.

CORK HARBOUR AND VICINITY.

I.—“PUBLIC” BEDS BETWEEN LITTLE ISLAND AND PASSAGE WEST.

Six oysters from this source were received from Dr. Browne on February 19th, 1903. Five were examined for *B. coli*, and the remaining one for *B. enteritidis*. Samples of water and of sandy mud also came to hand and were examined at the same time and for the same organisms. The result was that coli-form organisms were obtained from two of the five oysters; one of these was typical in all respects; the other (of the thick so-called *aerogenes* variety) was also typical save in its reaction to the neutral-red test. The sixth oyster proved to contain *Enteritidis*. The water yielded *Coli* in 1 c.c., the strain isolated agreeing with that obtained from the second of the two oysters as regards its reaction to neutral-red. The water did not yield *Enteritidis*. The sandy mud behaved as such specimens generally do, viz., positively to the test for *Enteritidis*, negatively to that for *Coli*.

Conclusion from Bacterioscopic Test:—Slight contamination of shell-fish—result as regards water, doubtful—no evidence as regards mud.

II.—FOATY BEDS (LORD BARRYMORE).

Six oysters from this bed, together with water and sandy mud, reached me on February 19th. Owing to lack of substrata only three of the six were examined for *Coli*, and one for *Enteritidis*. All the phenol-broth tubes remained sterile. The *Enteritidis* tube showed the typical change, and the positive result was confirmed by animal experiment. The water and mud were negative as regards *Coli* and positive for *Enteritidis*.

No evidence of sewage contamination was afforded by the bacterioscopic test in the case of these beds. The number of specimens examined was, however, too small to allow of any very definite conclusion.

On February 14th, 1903, I received from Dr. Browne a parcel containing six oysters from

III.—RATHCOURSEY BEDS, MIDLETON UNION (MR. SMYTH).

One of them (No. 5) proved to contain a mass of black mud instead of the mollusc, which had disappeared. The parcel also contained a sample of sea-water and one of mud from the layings.

Gelatine-plates were made with 0·1 c.c. mingled juice and shell-water from the following oysters:—Nos. 1, 2, 3, 4, as well as from the mud in No. 5.

Phenol-broth tubes were also made from Nos. 4, 5 (clay), and 6.

Milk-tubes, for the *Enteritidis* test, were done from all five oysters, as well as from the clay in No. 5.

The sea-water and mud were tested as usual.

Oyster 1.—The gelatine-plate eventually produced 206 colonies, corresponding to a germ-content of 2,060 per c.c. Seven of the largest colonies were *B. fluorescens*, three were *Proteus*, one was *Subtilis*. The non-liquefying germs were small, white, and undistinguished. Nothing resembling *Coli* developed. The *Enteritidis* result was negative.

Oyster 2.—Only thirty-six colonies on the gelatine plate corresponding to a germ-content of 360 per c.c. There was one *Proteus*, one of a yellow liquefying coccus, and others unidentified. *Coli* absent from plate. *Enteritidis* result negative.

Oyster 3.—Gelatine plate produced fifty colonies, corresponding to a germ-content of 500 per c.c. All the large colonies belonged to either *Proteus* (ten colonies) or *fluorescens* (five colonies). The non-liquefying species remained quite small. No *Coli* developed on plate. *Enteritidis* result negative.

Oyster 4.—Only twenty colonies on plate; germ-content, 200 per c.c. No *Coli*. A phenol-broth tube, made from this oyster, showed growth, but on plating-out failed to develop *Coli*. *Enteritidis* result negative.

Oyster 5.—This was found converted into or replaced by a mass of black mud. The plate-culture was inseminated by first transferring a loopful of this mud to 10 c.c. sterile broth, shaking well, and transferring a loopful of this suspension, without re-sterilising the needle, to the liquid gelatine (10 c.c.). This black mud was exceedingly poor in germs—at any rate in those capable of developing on gelatine with access of air. Only six small non-liquefying non-*Coli*-form colonies appeared. A phenol-broth tube, inoculated with a large loopful of the mud, remained sterile, but a similar loopful evoked the *Enteritidis* change in milk.

Oyster 6 was not plated out. It was examined for *Coli* by the Phenol-broth method, and the tube having shown growth was plated out as an Esmarch roll-culture. Typical "vine-leaf" colonies of *Coli* were thus obtained, and the organism so isolated stood all the tests. This oyster also yielded a somewhat atypical *Enteritidis* change in milk. The result was, however, confirmed by animal experiment.

The sea-water plated out (0·1 c.c.) on gelatine proved comparatively rich in germs, about 300 colonies being counted on the third day. Many of the larger non-liquefying ones resemble the thick or *aerogenes* variety of *Coli*. There were only three larger liquefiers. The phenol-broth tube, inoculated with 1 c.c. of the water, also yielded a positive result, but was over-diluted in plating out, so that the Esmarch roll-tube produced a single colony only, which was coli-form in appearance, and gave all the typical re-actions of *Coli*, save that to neutral-red. I have no doubt that one or other of the colonies on the gelatine plate would have proved absolutely typical, but unfortunately (in view of the + result in phenol-broth) they were not studied. The *Enteritidis* result was at first negative, but was repeated with positive result.

The sandy mud behaved as usual—negatively as regards *Coli*, positively as regards *Enteritidis*. Conclusions from bacterioscopic test:—Oysters slightly contaminated; water almost certainly so.

IV.—CARRIGRENNA BED (MRS. BURY).

Specimens of oysters (6), water, and mud were obtained by Dr. Browne on the 18th February, 1903, and forwarded to the Laboratory. Of the three oysters subjected to the phenol-broth test for *Coli*, one gave a positive result; another oyster was tested for *Enteritidis*, and also reacted positively.

From the water collected at these beds a coli-form organism was obtained, agreeing with that obtained from the Rathcoursey bed-water in its behaviour to neutral-red. The water did not yield *Enteritidis*.

The ground-formation behaved as usual.

Conclusion from Bacterioscopic Test.—Oysters slightly contaminated; water doubtful.

V.—COOLMORE AND AGHAMARTA BEDS (CARRIGALINE RIVER).

From these beds Dr. Browne obtained and forwarded to the Laboratory eight oysters and one mussel on the 25th February, 1903. Five of the oysters and the mussel were examined, with a less unequivocal result than the material from any of the other sources in this vicinity, four out of the five oysters yielding *Coli*, and the water as well. The results may be set forth as follows:—

- Oyster 1.—Filmy *Coli*; in milk-tube, much solid clot, little whey; evolution of gas; result not typical.
- Oyster 2.—Filmy *Coli*; typical *Enteritidis* change.
- Oyster 3.—Filmy *Coli*, the colonies of which remained rather small; *Enteritidis* tube not typical.
- Oyster 4.—No *Coli*; no *Enteritidis*.
- Oyster 5.—Filmy *Coli*; *Enteritidis* result typical.
- Mussel.—Negative for *Coli*; negative for *Enteritidis*.
- Water.—Positive for *Coli*; positive for *Enteritidis*.
- Mud.—Negative for *Coli*; positive for *Enteritidis*.

It is interesting to note that the river was in partial flood at the time these samples were collected by Dr. Browne. The state of the tide was "low water."

Conclusion from Bacterioscopic Test.—Decided evidence of sewage contamination of both shell-fish and water.

VI.—MUSSELS FROM CORK HARBOUR.

Of these I examined three batches, viz.—

- (1.) From River Lee off Little Island (five sent on the 18th February, 1903. Three examined for *Coli* and one for *Enteritidis*).
- (2.) From Meelough Bank (eight sent on the 23rd February. Six examined for *Coli* and two for *Enteritidis*).
- (3.) From Douglas Channel, between Railway Bridge and Hop Island (twelve sent on the 24th February, having been collected at low water. Owing to lack of substrata, only two of these were examined, one for *Coli*, the other for *Enteritidis*).

Batch 1 did not yield any *Coli*. The one tested for *Enteritidis* proved positive. (Number tested too few to allow of a definite conclusion.)

Batch 2 yielded three positive results out of six tested for *Coli*. The two *Enteritidis* tests likewise came out positive. (Decided evidence of sewage contamination.)

Batch 3.—The only mussel tested for *Coli* yielded that organism. The *Enteritidis* tube was unfortunately broken in the act of removal from the anaerobic apparatus, but from the cursory glance which I obtained, I am of opinion that the result would also have been positive.

(Sewage contamination of the mussels from localities 2 and 3 would therefore appear to exist, but further investigation and the examination of a greater number of specimens would be requisite in order to determine its precise degree.)

VII.—COCKLES FROM CORK HARBOUR.

The same sand-bank—Meelough—also furnished the only cockles sent me from this estuary. They were seventeen in number, and five of these were tested for *Coli* with positive results in three, whilst the other two yielded coli-form organisms more or less closely related to the typical *Bacillus*. *Enteritidis* was found in all three cockles tested for it, and also in the water and ground-formation of the sand-bank. Neither of these, however, yielded *Coli*.

Conclusion from Bacterioscopic Test.—These cockles are decidedly liable to sewage contamination.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
I. "Public" Beds between Little Island and Passage West.				
Oyster No. 1, . . .	—	Phenol-broth remained sterile,		} Not tested for <i>Enteritidis</i> .
" No. 2, . . .	+	Typical <i>Coli</i> . . .		
" No. 3, . . .	—	A few granular non-coli-form cols. on plate.		
" No. 4, . . .	+ ?	Coli-form of aerogenes type behaved atypically on neutral-red agar. Otherwise good <i>Coli</i> .		
" No. 5, . . .	—	Phenol-broth remained sterile,		} Typical change.
" No. 6, . . .		Not tested for <i>Coli</i> , . . .	+	
Water from same place, . . .	+ ?	Coli-form similar to that from No. 4.	—	
Sandy mud, . . .	—		+	Typical change.
II. Foaty Beds (Lord Barrymore).				
Oyster No. 1, . . .	—	{ All remained sterile in phenol-broth.		} Not tested for <i>Enteritidis</i> .
" No. 2, . . .	—			
" No. 3, . . .	—			
" No. 4, . . .		Not tested for <i>Coli</i> , . . .	+	Typical change.
Water from same place, . . .	—		+	"
Sandy mud, . . .	—		+	"

+ signifies that the organism tested for was found.
 — signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
III. Rathcoursey Beds (Mr. Smyth)				
Oyster No. 1, . . .		Plate only made ; 2,060 germs per c.c.	—	
„ No. 2, . . .		Plate only made ; 360 germs per c.c.	—	
„ No. 3, . . .		Plate only made ; 500 germs per c.c.	—	
„ No. 4, . . .	—	Phenol-broth tube became turbid but failed to yield <i>Coli</i> ; 200 germs per c.c.	—	
„ No. 5, . . .	—	This was really a mass of clay.	+	Typical change.
„ No. 6, . . .	+	“Filmy” <i>Coli</i> obtained from phenol-broth.	+	Change not very typical but result confirmed by animal experiments.
Water from same place, . . .	+ ?	Rich in germs, 3,000 per c.c., including <i>Coli</i> . Organism in phenol-broth tube abnormal to neutral-red.	+	First result atypical.
Mud „ „ . . .	—		+	
IV. Carrigrenna Beds (Mrs. Bury).				
Oyster No. 1, . . .	—			Not tested for <i>Enteritidis</i> .
„ No. 2, . . .	—			„ „ „
„ No. 3, . . .	+	Colonies of very irregular shape.		
„ No. 4, . . .		Not tested for <i>Coli</i> , . . .	+	Typical change.
Water from same place, . . .	+ ?	Organism obtained abnormal to neutral-red.	—	Milk unchanged.
Mud „ „ . . .	—		+	Typical change.
V. Coolmore and Aghamarta Beds (Carrigaline River).				
Oyster No. 1, . . .	+	Filmy variety of <i>Coli</i> . One col. of enormous size.	—	Result atypical.
„ No. 2, . . .	+	Filmy <i>Coli</i> cols. transversely elongated.	+	Typical change.
„ No. 3, . . .	+	Filmy <i>Coli</i> with rather small colonies.	—	Result atypical.
„ No. 4, . . .	—	Phenol-broth remained sterile,	—	Milk unchanged.
„ No. 5, . . .	+	Filmy <i>Coli</i> , . . .	+	Typical change.
Mussel from same place, . . .	—	No growth in phenol-broth,	—	Milk unchanged.
Water „ „ . . .	+	Filmy <i>Coli</i> .	+	Typical change.
Mud „ „ . . .	—		+	„ „
VI. (1) Mussels from River Lee, off Little Island.				
Mussel No. 1, . . .	—			} Not examined for <i>Enteritidis</i> .
„ No. 2, . . .	—			
„ No. 3, . . .	—			
„ No. 4, . . .		Not examined for <i>Coli</i> , . . .	+	Typical change.

+ signifies that the organism tested for was found.

— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
VI. (2) Mussels from Meelough Bank.				
Mussel No. 1, . . .	—	Phenol-broth turbid, but yielded only minute cols., probably Cocci.	}	Not tested for <i>Enteritidis</i> .
„ No. 2, . . .	+	<i>Coli</i> colonies transversely extended.		
„ No. 3, . . .	+	„ „		
„ No. 4, . . .	+	Ordinary <i>Coli</i> ,		
„ No. 5, . . .	—	Cocci only.		
„ No. 6, . . .	—	„ „	+	Typical change.
„ No. 7, . . .		Not tested for <i>Coli</i> , . . .	+	„ „
VI. (3) Mussels from Douglas Channel (between Railway Bridge and Hop Island).				
Mussel No. 1, . . .	+	Thick discoid variety of <i>Coli</i> ,	+	Not tested for <i>Enteritidis</i> . Typical change.
„ No. 2, . . .		Not tested for <i>Coli</i> , . . .		
VII. Cockles from Meelough Bank.				
Cockle No. 1, . . .	+	Phenol-broth yielded <i>Coli</i> which developed very slowly.	}	Not tested for <i>Enteritidis</i> .
„ No. 2, . . .	+	Typical <i>Coli</i> +liquefying colonies.		
„ No. 3, . . .	+	<i>Coli</i> developed very slowly in Esmarch roll tube.		
„ No. 4, . . .	—?	Very slow-growing colonies, weak fermenters of lactose.		
„ No. 5, . . .	—?	„ „ „		
„ No. 6, . . .		} Not tested for <i>Coli</i> ,	+	
„ No. 7, . . .			+	
„ No. 8, . . .			+	
Water from same place, . . .	—		+	Typical change in all.
Mud „ „ . . .	—		+	

COURTMACSHERRY HARBOUR.

From this locality I received a consignment of cockles, mussels, mud, and sea-water, collected on the 20th July by Dr. Browne, and examined them, as usual, with the following results:—*Coli* was found in every one of the six cockles, and in two of the five mussels. It was also found in as little as 1 c.c. of the water, but not in the mud.

Curiously enough, not one of the six cockles (different ones) tested for *Enteritidis* yielded a typical result. Of the five mussels, three yielded the *Enteritidis* change, whilst the other two remained atypical. The water was also atypical, but the mud was, as usual, positive.

It would thus appear that this locality is decidedly subject to sewage contamination.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Material used	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
Cockle No. 1,	+	Both vars. of <i>Coli</i> .	—	} All atypical. The cockles were not the same as those tested for <i>Coli</i> .
" " 2,	+	"	—	
" " 3,	+	Spreading var. only.	—	
" " 4,	+	Both vars. of <i>Coli</i> .	—	
" " 5,	+	Spreading var. only.	—	
" " 6,	+	"	+	
Mussel " 1,	—	Mainly Cocci.	+	} These were the same mussels as those tested for <i>Coli</i> .
" " 2,	+	Spreading var. of <i>Coli</i> .	—	
" " 3,	—	Phenol-broth negative.	+	
" " 4,	+	Spreading var. of <i>Coli</i> .	—	
" " 5,	—	Cocci only.	+	
Water,	+	Spreading var. of <i>Coli</i> , 1 c.c. used.	—	Result atypical.
Mud,	—	Cocci only.	+	Knife-pointful used. Result typical

CLONAKILTY HARBOUR.

On March 19th a parcel arrived at the Laboratory containing material collected and forwarded by Dr. Browne from this locality on the previous day. The material comprised :—

Twenty-one cockles from the Clonakilty strand;
Sea-water and sandy mud from the same strand.

All the samples had been taken at low water.

Five of the cockles were tested for *B. coli* by the M'Conkey method (culture in litmus-glucose-bile-salt-broth with fermentation tube), and subsequent plating upon gelatine. Five others were tested for *B. enteritidis sporogenes* by Klein's method. The quantity of material used for each test was, in the case of the cockles, all the shell water that could be collected, together with about one half of the mollusc, in each fermentation-tube and milk-tube. Of the sea-water 1 c.c., and of the sandy mud 3 large loops (about 20 mgm.), were the quantities taken.

In the result, all five cockles tested for *B. coli* proved to contain that organism, and all five tested for *B. enteritidis sporogenes* likewise gave positive results. The sandy mud yielded both *B. coli* and *B. enteritidis sporogenes*. The sea-water was found to contain *B. enteritidis* and a coli-form organism was also isolated from it; the specific tests, however, showed this organism to be devoid of the usual milk-coagulating power so characteristic of *B. coli*. In accordance with this character, it evolved but little gas from litmus-lactose-agar. It was also a weak producer of indol. It diverged from typical *B. coli* in the direction of the typhoid bacillus, but in the present state of knowledge we must be content to class it as a *pseudo-coli bacillus*, of doubtful significance.

As the result of these tests, I am of opinion that the Clonakilty cockles and strand show super-abundant evidence of sewage contamination.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Material used.	Tested for <i>B. coli communis</i> by M'Conkey's method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.		
	Result.	Remarks.	Material used.	Result.	Remarks.
Cockle 1, .	+	Fully 7.5 cm. gas in fermentation tube, which yielded the filmy var. of <i>Coli</i> almost pure.	Cockle 6, .	+	Typical <i>Enteritidis</i> change.
„ 2, .	+	6 cm. gas. Tube yielded both thick and <i>aerogenes</i> vars. of <i>Coli</i> .	„ 7, .	+	„ „
„ 3, .	+	4 cm. gas. Both vars. of <i>Coli</i> obtained.	„ 8, .	+	„ „
„ 4, .	+	2 cm. gas. Both vars. of <i>Coli</i> obtained.	„ 9, .	+	„ „
„ 5, .	+	Nearly 7.5 cm. gas. Filmy var. of <i>Coli</i> obtained.	„ 10, .	+	„ „
Water, .	—	Only 5 mm. gas. <i>Pseudo-Coli</i> obtained by plating-out.	Water, .	+	„ „
Mud, .	+	15 cm. gas. Liquid nearly all displaced. Typical <i>Coli</i> obtained, thick var.	Mud, .	+	„ „

NOTE:—In this series there was a duplicate set of milk tubes inoculated. One set was inoculated as usual. The other set was subjected to anaerobic conditions. The typical change was found to occur with equal frequency in the tubes exposed to the air. The significance of this result will be discussed in the Section devoted to methods. The results can be seen on Plate VI., figs. 2, and 3.

GLANDORE HARBOUR.

Specimens were collected here by R. J. Burke, M.D., on July 24th, and sent on to me. They consisted of mussels, water and mud. The result of the examination was that *Coli* was found in three of the mussels but not in the soil and water [1 c.c.]. *Enteritidis* was found in all save the water.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Material used.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
Mussel No. 1, . . .	+	Spreading var. of <i>Coli</i> , . . .	+	Result atypical.
„ No. 2, . . .	—	Mainly Cocci, . . .	+	
„ No. 3, . . .	—	Only 2 colonies on plate, . . .	+	
„ No. 4, . . .	—	Cocci and other non-coliform colonies.	+	
„ No. 5, . . .	+	Spreading var. of <i>Coli</i> +Cocci, . . .	+	
„ No. 6, . . .	+	„ „ „ . . .	+	
Water, . . .	—		—	
Mud, . . .	—	<i>Proteus</i> +Cocci, . . .	+	

ESTUARY OF ILEN RIVER.

Specimens from a Public Bed in this Estuary were forwarded to me by Dr. Browne on the 21st July, and were examined with the following result. *Coli* was detected in four out of six examined *ad hoc*, and was also obtained from as little as 1 c.c. of the water, but not from the mud. Out of five oysters examined for *Enteritidis*, three produced the typical change in milk. The mud and water were not examined for *Enteritidis*.

This locality would, therefore, appear to be considerably contaminated with sewage.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Material used.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
Oyster No. 1, . . .	+	Cocci only, . . . Destroyed by liquefaction, probably Cocci mainly.	+	Result atypical.
„ No. 2, . . .	+		—	
„ No. 3, . . .	+		+	
„ No. 4, . . .	—		—	
„ No. 5, . . .	—		+	
„ No. 6, . . .	+	Both vars. of <i>Coli</i> , . . .	}	Not tested.
Water, . . .	+	Typical spreading <i>Coli</i> , . . .		
Mud, . . .	+	<i>Coli</i> only, . . .		

ROARINGWATER BAY.

From this locality Dr. Browne collected and forwarded to me, on July 23rd, six oysters, water and mud. On arrival, one of the oysters was dead, but the other five, together with the mud and water, were examined as usual. In the result *Coli* was obtained from one oyster only, viz., No. 1, and neither from the mud nor the water [1 c.c.]. *Enteritidis* was present in nearly all the specimens.

+ signifies that the organism tested for was found.

— signifies that the organism was not found.

Material used.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
Oyster No. 1, . . .	+		+	
" No. 2, . . .	—	Phenol-broth sterile, .	+	
" No. 3, . . .	—	" " " .	+	
" No. 4, . . .	—	" " " .	+	
" No. 5, . . .	—	Liquefiers and Cocci, .	+	
Water, . . .	—	Liquefiers only, .	—	
Mud, . . .	—	Liquefiers and Cocci only, .	+	

GLENGARRIFF (BANTRY BAY).

Dr. Browne collected a batch of material from this locality on the 21st July. The result of the examination was that all six oysters examined for *Coli* were found to contain that organism, which was also found in the water and the mud from the layings. All six likewise yielded *Enteritidis*, and so also did the mud, but not the water. The contamination of this oyster bed would therefore appear to be almost maximal in amount.

+ signifies that the organism tested for was found.

— signifies that the organism was not found.

Material used.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
Oyster No. 1, . . .	+	Typical <i>Coli</i> of either variety found in all.	+	Result atypical.
" No. 2, . . .	+		+	
" No. 3, . . .	+		+	
" No. 4, . . .	+		+	
" No. 5, . . .	+		+	
" No. 6, . . .	+		+	
Water, . . .	+		—	
Mud, . . .	+		+	

COAST OF COUNTY OF KERRY.

ESTUARY OF KENMARE RIVER.

The result of the examination of material taken from McClure's Bed at Templenoe on the 22nd July was that *Coli* was obtained from three out of six oysters, but not from the soil, nor from the water in quantities of 1 c.c. There were only two typical *Enteritidis* changes produced by the oysters, and the mud also, as usual, gave the change.

From Sir J. Colomb's Bed at Derryquinna similar results were obtained, viz., *Coli* in three oysters out of six, but neither in the mud nor from 1 c.c. of the water. *Enteritidis* also occurred in three out of the same six oysters and in the mud.

From Dereen Oyster Beds in the same "river" no better results were forthcoming, *Coli* being found in three of the six oysters, but not in mud or 1 c.c. of the water. *Enteritidis* was also obtained from three out of the six oysters as well as from the mud.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
I. Oysters from McClure's Bed, Templenoe, Kenmare River.				
Oyster No. 1, . . .	+	Filmy var. of <i>Coli</i> , . . .	— ?	Somewhat atypical.
" No. 2, . . .	—	Phenol-broth sterile, . . .	— ?	" "
" No. 3, . . .	+	Filmy <i>Coli</i> , . . .	+	
" No. 4, . . .	—	Phenol-broth sterile, . . .	—	Unchanged.
" No. 5, . . .	—		— ?	Somewhat atypical.
" No. 6, . . .	+		+	
Water, . . .	—		—	Result atypical.
Mud, . . .	—		+	
II. Oysters from Sir J. Colomb's Bed, Derryquinna, Kenmare River.				
Oyster No. 1, . . .	—	Phenol-broth sterile, . . .	+	
" No. 2, . . .	+	Filmy var. of <i>Coli</i> , . . .	—	Result atypical.
" No. 3, . . .	—	Phenol-broth sterile, . . .	+	
" No. 4, . . .	+		—	Result atypical.
" No. 5, . . .	+		—	"
" No. 6, . . .	—	A few small non-coli-form cols. on plate.	+	
Water, . . .	—		—	Result atypical.
Mud, . . .	—		+	
III. Oysters from Derreen Beds, Kenmare River (sent by G. Brennan, 26th July, 1903).				
Oyster No. 1, . . .	—	Phenol-broth sterile, . . .	+	
" No. 2, . . .	+	Spreading filmy <i>Coli</i> , . . .	—	Result atypical.
" No. 3, . . .	+	" " " " . . .	+	
" No. 4, . . .	? +	Not good <i>Coli</i> . . .	+	
" No. 5, . . .	+	Spreading filmy <i>Coli</i> , . . .	—	Result atypical.
" No. 6, . . .	—	Phenol-broth sterile, . . .	—	"
Water, . . .	—		—	Unchanged.
Mud, . . .	—		+	

TRALEE BAY.

On March 11th a parcel arrived from Tralee, having been despatched by Dr. Browne on the previous day. It contained ten oysters from the public beds at "Foley's Hole," Tralee Bay. They were small, apparently young oysters, but seemed fairly nourished. A specimen of sandy mud and one of water from the beds reached me at the same time.

Five of the oysters were examined for *B. coli communis*, and the other five for *B. enteritidis sporogenes*.

The sandy mud and sea-water were examined for both organisms.

These materials were subjected to a particularly close investigation for *B. coli*. I had become convinced of the desirability of determining which of the three tests for *B. coli* in common use, gave the speediest, most delicate, and most reliable result, and I accordingly submitted each of the five oysters of this batch to all three tests. The tests referred to are :—

(1.) That recommended by Klein in his recent paper "On the Bacterioscopic Diagnosis of Sewage pollution of Shell-fish" (*British Medical Journal*, February 21st, 1903), viz.:—Culture in litmus-lactose-peptone water, with fermentation-tube.

(2.) That introduced by McConkey (culture in litmus-glucose-bile-salt-bouillon with fermentation-tube), and

(3.) That associated with the name of Parietti, and which I have been in the habit of employing for several years (culture in ordinary bouillon containing a certain percentage of carbolic and hydrochloric acids).

All the liquid obtainable from each oyster—a mixture of body-juices and shell water—was carefully collected, mingled in a test-tube, and 1 c.c. of the mixture added to a tube containing the culture-fluid prescribed for each of the above methods. The procedure was carried out aseptically.

Of the sandy mud, three large loopfuls, and of the sea-water, 1 c.c. were the quantities taken and tested by each method. The mud was previously well shaken up with some sterile tap-water in order to homogenise it so far as possible, and the water was, of course, also shaken up.

By way of control, a dilute suspension of human fæces (freshly passed)—one small loopful to 10 c.c. sterile tap-water was made and filtered, and of the filtrate 0.1 c.c. (= one-hundredth of a small loopful of the fæces) added to a culture-tube of each kind. A control gelatine-plate was made at the same time with the same amount of the fæces-suspension, which, I may say, was thus shown to be poorer in *B. coli* than I had anticipated, only a single typical colony developing on the plate.

It is not my present object to discuss in detail the interesting comparative results obtained from this experiment. To do so would be to depart from the main purpose of this report, which is to communicate to the Local Government Board the result of the bacterioscopic test for sewage contamination as

applied to the shell-fish, &c., from this locality. That result, as regards the oysters, is as follows :—

Oyster 1 yielded an actively motile non-Gram-staining bacillus, which gave rise to typical coli-form colonies on gelatine; “bubbled” glucose-gelatine-shake-cultures, grew typically on potato, and produced abundance of indol. From typical faecal *Coli* it differed, however, in the following respects:—It was not an active fermenter of lactose, producing but little gas and acid in litmus-lactose-agar-shake-culture; it reddened litmus-tinged milk, but failed to coagulate it after four days’ incubation at 37°; and it failed to comply with the neutral-red test. This micro-organism cannot, therefore, be classed as genuine *B. coli*. It must be ranked with the outlying coli-form organisms, the resemblance of whose colonies on gelatine-plates to those of the “genuine” *B. coli* so greatly increases the difficulty of the examination by rendering it necessary for the Bacteriologist to apply a lengthy series of tests before he can be certain that he is dealing with true *Coli* of faecal origin. *This oyster was negative to the Parietti test, the pseudo-Coli* above described having been obtained by fermentation-tube methods.

Oyster 2 yielded, by the same methods, the same organism as that above described. *With the Parietti method it gave a negative result.*

Oyster 3 was the only one of the five that responded to the Parietti test, and the colonies on the gelatine-plate proved to be genuine *B. coli*, typical in every respect. M’Conkey’s method here yielded an organism possessing characteristics identical with those described under *Oyster 1*, whilst the Klein-tube proved to contain a similar coli-form organism, which more closely approximated to genuine *Coli* by one important character—viz., it coagulated milk on the second day of incubation.

Oyster 4 was negative to the Parietti test, but yielded by the two other methods an organism like that described under *Oyster 1*, save as regards its growth on potato, which was typhoid-like.

Oyster 5.—This gave a result similar to that obtained from *Oysters 1, 2, and 4*, viz., negative with Parietti, and a *pseudo-Coli* with the fermentation-tube.

Coming now to the results of the *Enteritidis* test as applied to the oysters, all five yielded positive results. The quantity of material used to inseminate the tubes was 1 c.c. mixed juice and shell-water.

The sea-water yielded typical *Coli* to all three methods, and also responded to the *Enteritidis* test. The sandy mud also yielded genuine *Coli* to all three methods. Its behaviour to the *Enteritidis* test was somewhat atypical, the cloth being a little too solid, whilst the quantity of gas evolved seemed rather small. The culture was not tested on an animal.

It may be well to state here that the control-tubes inseminated with 0·1 c.c. of the dilute faecal suspension yielded typical *Coli* to all three methods. The milk-tubes inseminated with 1 c.c. of the liquid gave the typical *Enteritidis* change.

Another parcel of material from Tralee came to hand on 19th May, 1903. It consisted of ten oysters, a bottle of water, and some sandy mud. The package bore a printed label, “Sanitary Oysters from McCowen’s Oyster Parks, Tralee.” The oysters were alive and quite fresh. The material had, I presume, been despatched in accordance with directions left by Dr. Browne, who was at Carlingford at the time these samples reached me. I accordingly included them in the next batch of material subjected to analysis after their arrival.

Of the ten oysters sent, six were examined for *Coli* by the phenolated-broth method, and the same six by Klein's method for *B. enteritidis sporogenes*. 1 c.c. of the mingled juice and shell-water was used for each tube. Of the six phenolated-broth-tubes, three remained sterile, two yielded Cocci, and from one was obtained an organism producing typical colonies of *coli-form* character on gelatine, and proving on examination to be typical *Coli*.

In testing the water for *Coli* a much larger quantity was used than on the former occasion, viz., 50 c.c. From it *Coli* was not, however, obtained—only a micrococcus producing white granular liquefying colonies on the gelatine.

In testing the mud for *Coli* a much larger quantity was also used than on the previous occasion. The whole quantity sent was well shaken up with about 50 c.c. sterile water, and about 20 c.c. of the turbid mixture used for the analysis. It yielded *coli-form* colonies of both the "Vine-leaf" and the *discoid aerogenes* type, both of which proved to be typical *Coli*.

Turning now to the result of the tests for *B. enteritidis sporogenes*, not one of the oysters yielded a typical result. Growth took place in three of the six tubes with complete bleaching of the litmus and formation of a thin layer of translucent serum beneath the cream, but there was no evolution of gas and consequently no splitting up of the curd. Both mud and water yielded *Enteritidis* from the usual quantities.

It will thus be seen that McCowen's beds yielded a result very similar to that obtained in the case of the oysters from the "public" beds examined over two months earlier. The results as regards *Enteritidis* were distinctly more favourable, not one typically positive result having been obtained. The significance of this, however, I look upon as very doubtful.

I subjoin a tabular statement of the results above communicated.

TRALEE BAY.

+ indicates that the organism tested for was found.
 — indicates that the organism tested for was not found.

"PUBLIC" BEDS, examined March 13th, 1903.				MCCOWEN'S BEDS, examined May 20th, 1903.							
Tested for <i>B. coli</i> communis.			Tested for <i>B. enteritidis sporogenes</i> .		Tested for <i>B. coli</i> communis.			Tested for <i>B. enteritidis sporogenes</i> .			
Material used.	Result.	Remarks.	Material used.	Result.	Remarks.	Material used.	Result.	Remarks.	Material used.	Result.	Remarks.
Oyster 1, .	—	Pseudo-coli.	Oyster 6, .	+	Typical.	Oyster 1, .	—	<i>Nil.</i>	Oyster 1, .	—	Litmus bleached, yellow whey below cream, no gas.
Oyster 2, .	—	"	Oyster 7, .	+	"	Oyster 2, .	—	Cocci obtained.	Oyster 2, .	—	Violet serum below cream. No gas.
Oyster 3, .	+	True coli.	Oyster 8, .	+	"	Oyster 3, .	—	<i>Nil.</i>	Oyster 3, .	—	As in No. 1.
Oyster 4, .	—	Pseudo-coli.	Oyster 9, .	+	"	Oyster 4, .	—	<i>Nil.</i>	Oyster 4, .	—	Coagulated below cream, reaction acid, but no gas.
Oyster 5, .	—	"	Oyster 10, .	+	Clot a little more solid than usual.	Oyster 5, .	—	Cocci obtained.	Oyster 5, .	—	As in No. 1.
Water [1 c.c.], .	+	True coli.	Water [1 c.c.], .	+		Oyster 6, .	+	Typical "Vine-leaf" <i>Coli.</i>	Oyster 6, .	—	As in No. 1.
Mud [about 20 mgm.], .	+	True coli.	Mud [20 mgm.], .	? +	Evolution of gas less distinct than usual.	Water [50 c.c.], .	—	Liquefying Cocci.	Water [1 c.c.], .	+	
						Mud [20 c.c. suspension], .	+	Coliform of "Vine-leaf" and <i>aerogenes</i> type.	Mud [20 mgm.], .	+	

ESTUARY OF RIVER SHANNON.

From Carrig Island (Mr. Sandes' Beds) ten oysters, together with the usual specimens of mud and sea-water, were forwarded by Dr. Browne on March 18th, and received by me next day in good condition. They were examined, together with the material from Clonakilty, on the 21st, having remained meanwhile in the refrigerator.

For the demonstration of *B. coli*, the M'Conkey method, and for that of *B. enteritidis sporogenes*, that of Klein, were employed. The usual quantities of material were used for inseminating the tubes. In applying the *Enteritidis* test, a duplicate set of milk-tubes was inoculated from each oyster, and one series was incubated in a Bulloch's apparatus under strictly anaerobic conditions, whilst the other series was placed without special precaution in the incubator.

The result after three days' incubation was that as many positive results were obtained in the aerobic series as in the anaerobic. The microscopic examination of the typically altered milk showed similar micro-organisms in the two series. Animal experiment showed that the virulence of the material contained in the anaerobic tubes was equalled, and in some cases surpassed, by that of the contents of the aerobic series. As the result of culture-experiments it was further found that the contents of the tubes that had undergone the typical *Enteritidis* alteration under aerobic conditions did *not* contain micro-organisms capable of developing in surface-culture on agar or gelatine plates exposed to the air. The inference is that the superficial layer of cream excludes the atmosphere. The significance of these results is not *principal*, for they leave the anaerobic nature of the process unquestioned, but it is highly *practical* as justifying a valuable simplification of the procedure recommended by Klein for the demonstration of *B. enteritidis*, viz.:—the omission of the steps necessary to secure anaerobiosis—a most important consideration where many tubes have to be dealt with at one operation.

The outcome of the test as applied to the materials from this locality is, briefly, the following:—

Not one of the five oysters examined for *B. coli* was proved to contain that organism. On the other hand all the five examined for *B. enteritidis* gave positive results either aerobically or anaerobically.

The sandy mud yielded *B. enteritidis*, but not *B. coli*. The water, however, yielded the anomalous result that whereas *B. enteritidis* was not found a typical strain of *B. coli* was readily obtained from it, giving all the characteristic reactions save that its growth on potato was rather more suggestive of that of the Typhoid bacillus.

There was thus no evidence that the shell-fish from this source were polluted, and were it not for the result of the water-examination, these beds might readily pass the bacterioscopic test as uncontaminated, but in view of the fact which was ascertained beyond all doubt that the sample of sea-water taken by Dr. Browne at this locality, contained *B. coli* in 1 c.c., the results of the test can hardly be regarded as otherwise than inconclusive.

It is quite conceivable that the contamination of the water may have been due to the sewage of the City of Limerick, situate about twenty miles higher up the river.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Tested for <i>B. coli communis</i> by M'Conkey's method (3 days at 37° and subsequent plating.)			Tested for <i>B. enteritidis sporogenes</i> by Klein's method.		
Material used.	Result.	Remarks.	Material used.	Result.	Remarks.
Oyster 1, .	—	3.75 cm. gas in fermentation tube. Plating out yielded only Cocci.	Oyster 6, .	+	Aerobic milk tube positive. Anaerobic negative.
„ 2, .	—	No gas—litmus reddened.	„ 7, .	+	Aerobic milk tube doubtful. Anaerobic more typical.
„ 3, .	—	3.1 cm. gas: litmus alkaline without, reduced within. No <i>Coli</i> on plate.	„ 8, .	+	Both milk tubes typical.
„ 4, .	—	3.1 cm. gas. Plating yielded only <i>Proteus</i> .	„ 9, .	+	Aerobic more typical. Anaerobic less so.
„ 5, .	—	Hardly anything on plate, though some gas developed in tube.	„ 10, .	+	Aerobic typical. Anaerobic quite atypical.
Water, .	+	2 inches (5 cm.) gas in tube. Typical "Vine-leaf" <i>Coli</i> on plate.	Water, .	—	Solid clot with serum and without gas by both methods
Mud, .	—	20 grams tested by growth in phenolated-lactose-broth with negative result.	Mud, .	+	Typical result by aerobic method. No anaerobic culture made.

COAST OF COUNTY OF CLARE.

The two oyster-beds near Burren in this county yielded—in complete accordance with their well-known character—totally negative results both for *Coli* and *Enteritidis*.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
I. Mr. Mannix's Beds, Burren, Co. Clare. (10-4-03).				
Oyster No. 1, . . .	—	Phenol-broth sterile,	—	No change.
„ No. 2, . . .	—	„ „	—	„
„ No. 3, . . .	—	„ „	—	„
„ No. 4, . . .	—	„ „	—	„
„ No. 5, . . .	—	„ „	—	„
„ No. 6, . . .	—	„ „	—	Litmus milk bleached below.
Water from same place, .	—	„ „	—	No change.
Mud „ „ .	—	„ „	—	„
II. "Red Bank" Layings, Burren, County Clare. (31-3-03).				
Oyster No. 1, . . .	—	This Oyster tested by both the Klein and the M'Conkey methods as well as by the phenol-broth: negative results with all.	—	} Milk unchanged.
„ No. 2, . . .	—		—	
„ No. 3, . . .	—			} Not examined for enteritidis.
„ No. 4, . . .	—			
Water from same place, .	—		—	} Milk unchanged.
Mud „ „ .	—		—	

COAST OF COUNTY OF GALWAY.

Material was sent from eighteen localities on the extensive seaboard of this county, and it will be noticed that the results of the examination were almost completely negative as regards *Coli*, save in one locality, viz., the Quay, Galway. The results column of the tabulated statement subjoined would appear to suggest that the layings in question are in close proximity to a sewer outfall.

I cannot account for the presence of *pseudo-Coli* at Pollagh and Mulroog. It will be noted that *Enteritidis* also occurs much less frequently than usual, and, curiously enough, it would appear to have been absent from the oysters and mussels at Galway Quay. This may probably be accounted for by the fact that the number examined *ad hoc* was not sufficiently large.

+ signifies that the organism tested for was found.

— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
I. Layings at Crushena, Kinvara Bay. (Public Beds). (2-4-03).				
Oyster No. 1, . . .	—	} No development in any of these broth tubes.	?	Change atypical, but tube contained Gram-staining Bacilli resembling <i>Enteritidis</i> .
„ No. 2, . . .	—		—	} No typical change in any of these.
„ No. 3, . . .	—		—	
Water from same place, . . .	—		—	
Mud „ „ . . .	—		—	
II. Layings at Clarenbridge, Co. Galway. (Messrs. Neilan and Lenehan's). (26-3-03).		Medium-sized fairly plump Oysters.		
Oyster No. 1, . . .	—	Phenol-broth tube failed to develop.	—	
„ No. 2, . . .	—	„ „ „	—	
„ No. 3, . . .	—	„ „ „	—	Not examined.
Sea-water from same place, . . .	—	50 c.c. tested by addition of lactose-peptone-litmus mixture.	—	Milk unaltered (1 c.c. sample used.)
Mud „ „ . . .	—	About 20 c.c. washings of entire specimen tested.	—	3 large loopfuls used.
III. Layings at Clarenbridge, Galway Bay. (Public Beds). (26-3-03).				
Oyster No. 1, . . .	—	Same remark as in case of last group.	—	
„ No. 2, . . .	—	} „ „ „	—	} This milk tube inoculated with a mixture of the juices of Oysters 2 and 3—amount used, 1.1 c.c.
„ No. 3, . . .	—		—	
Sea-water from same place, . . .	—	50 c.c. tested as in case of last group.	—	—
Mud „ „ . . .	—	Only cocci on plate, . . .	+	On microscopical examination typical Gram-staining rods.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
IV. Layings at Clarenbridge, Galway Bay. (Tyrone Beds). (26-3-03).				
Oyster No. 1, . . .	—	Coli-form organism—atypical in several respects.	—	Not examined. Milk unchanged.
„ No. 2, . . .	—		—	
„ No. 3, . . .	—		—	
Sea-water from same place, .	—	Sporing anaerobes grew in broth. Nothing resembling coli on plate.	—	Typical Gram-staining rods pure.
Mud „ „ .	—		+	
V. Layings at Renville, Oranmore Bay. (Dr. W. P. Kirwan, 31-3-03).				
Oyster No. 1, . . .	—	None of the phenol-broth tubes showed development.	—	} No change in either. Not examined.
„ No. 2, . . .	—		—	
„ No. 3, . . .	—		—	
Water from same place, .	—	Development in broth, but plating out yielded nothing.	—	Typical result.
Mud „ „ „ .	—	„ „ „ „	+	
VI. Layings at Ardfry, Oranmore, Co. Galway. (New Harbour). (26-3-03).				
Oyster No. 1, . . .	—	The phenol-broth showed development, but the plate made from it remained sterile? Anaerobes.	+	Typical Gram-staining rods.
„ No. 2, . . .	—	} Phenol-broth sterile, .	—	Milk unchanged. Not examined.
„ No. 3, . . .	—		—	
Sea-water from same place, .	—	Broth became turbid, but the plate was sterile? Anaerobes.	—	Typical Gram-staining rods.
Mud „ „ .	—		+	
VII. Layings close to Quay, Galway. (Public Bed.) (27-3-03.)				
Oyster No. 1, . . .	+	Typical coli, resembling typhoid in its growth on potato, isolated.	—	Not examined.
„ No. 2, . . .	—	Phenol-broth gave no growth,	—	
„ No. 3, . . .	+	Undoubted coli, though a little weak as an indol former.	—	
Mussel No. 1, . . .	+	Absolutely typical coli obtained.	—	Litmus milk bleached, but neither coagulation nor gas-formation. Typical Gram-staining rods. Took a day longer incubation before + result certain.
„ No. 2, . . .	—	The phenol-bouillon gave growth, but nothing grew on the plate—anaerobes.	—	
Water from same place, .	—		+	
Mud „ „ .	—		+	
VIII. Layings at Cashel Bay, Co. Galway. (Mr. Berridge's.) (30-3-03).				
Oyster No. 1, . . .	—	All three phenol-broth tubes remained sterile. Only .8 c.c. juice obtained from No. 2.	+	Typical Gram-staining rods.
„ No. 2, . . .	—			The entire juice of these two oysters used for the enteritidis test. Typical result.
„ No. 3, . . .	—			
„ No. 4, . . .		Not examined for coli, „ „ „	+	
„ No. 5, . . .				
Water from same place, .	—	Phenol-broth gave no growth,	—	Took a day longer incubation to obtain + result.
Mud „ „ .	—	„ „ „	+	

+ signifies that the organism tested for was found.
 — signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
IX. Layings at Cashel Bay, Co. Galway.—“The Pond.” (Mr. Berridge's). (30-3-03).				
Oyster No. 1, . . .	—	None of the phenol-broth tubes showed development.	—	} No change in either. Not examined.
„ No. 2, . . .	—			
„ No. 3, . . .	—			
X. Mr. W. Evans Jackson's Layings in Mannin Bay. (29-4-03).				
Oyster No. 1, . . .	--	Phenol-broth sterile, . . .	—	No change.
„ No. 2, . . .	—	Strepto cocci in broth, . . .	—	Bleached below.
„ No. 3, . . .	—	Phenol-broth sterile, . . .	—	„ „
Water from same place, . . .	? +	Typhoid-like growth on potato, . . .	—	Result atypical.
Mud „ „ . . .	—	Phenol-broth sterile, . . .	+	Typical change.
XI. Layings at South Faul, Ardbear Bay, Co. Galway. (Mr. Jackson's.) (31-3-03).				
Oyster No. 1, so-called “Marketable Oyster.”	—	This Oyster (No. 4) tested by Klein and M'Conkey methods as well as by phenol-broth. The M'Conkey method yielded a coli-form organism rejected for non-compliance with milk, indol, and potato tests.	—	} Milk unchanged. } Not examined.
„ No. 2, do. . . .	--		—	
„ No. 3, . . .	—		—	
„ No. 4, . . .	—		—	
Water from same place, . . .	—	Sporing anaerobes developed in broth.	+	Typical Gram-staining rods.
Mud „ „ . . .	—			
XII. Layings at North Faul, Clifden Bay (Mr. Jackson's). (31-3-03). So-called “Growing Beds.”				
Oyster No. 1, . . .	—	Phenol-broth sterile, . . .	—	} Milk unchanged.
„ No. 2, . . .	—	„ „ . . .	—	
„ No. 3, . . .	—	„ „ . . .	—	} Not examined.
„ No. 4, . . .	—	„ „ . . .	—	
Water from same place, . . .	—	„ „ . . .	+	Typical Gram-staining rods.
Mud „ „ . . .	—	„ „ . . .		
XIII. Layings at Ballinakill Bay, Co Galway. (Atlantic Oyster Co). (1-4-03).				
Oyster No. 1, . . .	—	No development in any of the phenol-broth tubes.	+	One milk tube out of 2 inoculated from this oyster showed typical changes.
„ No. 2, . . .	—		—	Milk unchanged.
„ No. 3, . . .	—		—	} Not examined.
„ No. 4, . . .	—		—	
Water from same place, . . .	—		—	Milk unchanged.
Mud „ „ . . .	—		+	Typical change.

+ signifies that the organism tested for was found.
 — signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
XIV. Layings at Ballinakill, Fahy Bay, Co. Galway, so-called "Public Beds." (1-4-03). Oyster (the only one sent), . Water from same place, . Mud " " .	— — —	Development in broth, but nothing on plate. Anaerobes.	— — +	One of two duplicates became bleached, but not typical change. Typical change.
XV. Layings at Dawros Beg, Ballinakill Bay (Atlantic Oyster Co.) (2-4-03). Oyster No. 1, } " No. 2, } All that were sent. " No. 3, } Water from same place, . Mud " " .	— — — — —	No growth in any of these phenol-broth tubes.	— — + — +	Typical change in one of two tubes inoculated from this oyster. Typical change came on rather slowly.
XVI. Layings at Barnaderg Bay, Letterfrack (Mitchell Henry's). (2-4-03). Oyster No. 1, } " " 2, } All that were sent. " " 3, } Water from same place, . Mud " " .	— — — — —	No development in any of these broth tubes.	— — — — +	No typical change in any of these milk tubes. Typical change.
XVII. Layings at Pollagh and Mulroog (Mr. St. George). (3-4-03). Oyster No. 1, . " " 2, . " " 3, . Water from same place, . Mud " " .	+ + — — —	Typical coli, save that it formed no indol. Coli-form rejected on several tests. Broth yielded no growth. Growth in broth, but ? anaerobes only.	+ + — — +	Interesting to note that these were the two oysters that yielded the coli-form organisms.
XVIII. Layings at Leenane, Killary Bay (Mussels only). Mussel No. 1, . " No. 2, . Water from same place, . Mud " " " . Mussel No. 3, . " No. 4, .	— — — — — —	Cocci developed in the phenol-broth.	— — — + — —	Not examined for enteritidis. Typical change. Changes in both milk tubes but not typical.

COAST OF COUNTY OF MAYO.

The number of layings in this county subjected to examination was much smaller than in the case of County Galway. The number of specimens sent from the Illaunballa Oyster Bed in Killary Harbour was too small to afford support to a definite conclusion. The Leenane mussel-bed, however, corroborates the negative result, and proves to be quite pure. The same remark applies to Renaughan, Blacksod Bay, which does not yield one positive result out of nine samples tested. The Canal near Belmullet, however, would appear to yield maximally contaminated shell-fish, and to contain contaminated mud and water. The results in the case of the layings at Moyne Pool, Killala, are less unequivocal, and seem to require confirmation or the reverse by further testing.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Specimen.	Tested for <i>B. coli</i> communitis by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
I. Layings at Illaunballa Island, Killary Bay (Co. Mayo). (3-4-03).				
Oyster No. 1 } All that were sent	—	No development in any of these phenol-broth tubes.	—	No change in these milks.
" No. 2 }	—		—	
Water from same place, .	—		—	
Mud " " " .	—		+	Typical change.
II. Layings at Renaughan, Blacksod Bay. (3-6-03).				
Oyster No. 1, . . .	—	Phenol-broth sterile, .	—	No change.
" No. 2, . . .	—		—	
Oysters Nos. 3 and 4, .	—	Liquefying coli only, .	—	Result atypical.
Oyster No. 5, . . .	—	Same result, . . .	—	
" No. 6, . . .	—	Phenol-broth sterile, .	—	No change.
" No. 7, . . .	—		—	
Water from same place, .	—	Very doubtfully coli-form, .	—	
Mud " " " .	—	Moulds only on plate, .	+	
III. Layings at side of Canal leading from Blacksod Bay to Broadhaven Bay. (3-6-03)				
Oyster No. 1, . . .	+	Both vars. of coli, . . .	+	Typical change.
" No. 2, . . .	+	Same result, . . .	+	
" No. 3, . . .	+	" . . .	+	
" No. 4, . . .	+	Thin var. of coli, . . .	+	
" No. 5, . . .	+	Same result, . . .	+	
Water from same place, .	+	" . . .	—	No change.
Mud " " " .	+	" . . .	+	Typical change.
IV. Col. Knox-Gore's layings, Moyne Pool, Killala. (6-7-03).				
Oyster No. 1, . . .	—		—	Unchanged.
" No. 2, . . .	—		—	Atypical coagulation.
" No. 3, . . .	—		—	Unchanged.
" No. 4, . . .	—		—	
Water from same place, .	+	Result ? with 1 c.c., positive with 50 c.c.	—	Result atypical.
Mud " " " .	+	Result negative with knife-pointful, positive with 50 grams.	+	Typical change.

COAST OF COUNTY OF SLIGO.

Specimens were forwarded by Dr. Browne from three localities on the coast-line of this County, viz., Ballysodare Bay (eight separate layings), and Sligo and Drumcliffe Bays (from one oyster bed in each). Of the eight layings in Ballysodare Bay, *Coli* was altogether absent from one only (Cochrane's). The two most heavily contaminated were Baker's (three oysters certainly, one probably, mud and water positive, equal to five certainly positive out of eight specimens tested) and Browne's, with four oysters and the mud positive. In the case of the last-named bed, larger quantities than usual of oyster-fluid were used for the test. All the other beds were infected, though to a lesser degree. Out of a total of 68 specimens examined from the shores of this Bay, and counting doubtful results as negative, *Coli* was found in 18, or 26·5 per cent. Omitting the specimens of mud and water and counting only the shell-fish, the result is nearly the same, viz., 12 positive results out of 51 examinations, or 23·5 per cent.

On the other hand, *Enteritidis* does not seem to occur here as often as one might expect, judging from the relatively large proportion of *Coli*-containing specimens. In 68 examinations it was found 28 times, or at the rate of 41 per cent. This comparatively small percentage would be still further diminished if we omit Baker's layings, the specimens from which *all* contained the organism. It would then work out at 36·6 per cent.

Sligo Bay would appear to belong to the category of heavily infected localities, the single oyster-bed there having yielded no less than five *Coli*-containing oysters out of six, whilst the water also contained it in 50 c.c.

With regard to Drumcliffe Bay, out of seven specimens examined, only one yielded coli-form organisms (a mussel).

Appended is the tabulated statement.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
Ballysodare Bay.				
I. Browne's Layings [28. 5. 03.]				
Oyster No. 1, . . .	+	Typical <i>Coli</i> . Cocci as well.	+	
„ No. 2, . . .	—	1·5 c.c. oyster juice used—Cocci only.	—	0·5 c.c. juice used ; clot solid ; no gas.
„ No. 3, . . .	+	2·5 c.c. juice used ; both vars. of <i>Coli</i> obtained.	—	2·5 c.c. juice used ; milk unchanged at end of 5 days.
„ No. 4, . . .	—	Phenol-broth remained sterile.	+	
„ No. 5, . . .	+	2 c.c. juice used.	—	1·5 c.c. juice used. Result atypical like O. 2 above.
„ No. 6, . . .	+	2·5 c.c. juice used ; Cocci preponderated in turbid phenol-broth.	+	2 c.c. juice. Result typical.
Water from same place, . . .	—	No <i>Coli</i> in 50 c.c.		} No note of these results.
Mud „ „ „ . . .	+	<i>Coli</i> obtained from 50 grams.		
II. Cooper's Layings [28. 5. 03.]				
Oyster No. 1, . . .	—	2 c.c. juice used ; phenol-broth became turbid but plate remained sterile—anaerobes.	+	2 c.c. juice used.
„ No. 2, . . .	—	2 c.c. juice used ; phenol-broth remained sterile.	—	Atypical ; clot solid ; no gas.
„ No. 3, . . .	—	„	—	
„ No. 4, . . .	—	„	—	Slight translucency beneath cream.
„ No. 5, . . .	+	1·75 juice used and veil-like <i>Coli</i> obtained.	—	Unchanged.
„ No. 6, . . .	—	2 c.c. juice used ; phenol-broth remained sterile.	+	
Water from same place, . . .	—	No <i>Coli</i> in 50 c.c.		} No note of these results.
Mud „ „ „ . . .	—	Cocci only from 50 grams.		

+ signifies that the organism tested for was found.

— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
III. Roe's Layings [28.5.03].				
Oyster No. 1, . . .	—	Doubtful turbidity in phenol-broth, <i>nil</i> on plate.	—	Atypical; clot solid; no gas.
„ No. 2, . . .	—	Phenol-broth became turbid, but hardly anything appeared on plates. Anaerobes.	—	Nearly typical. A little serum below cream.
„ No. 3, . . .	—		? +	
„ No. 4, . . .	—		—	
Marly clay from Mussel No. 1, . . .	—	Phenol-broth sterile, . . .	+	Unchanged.
Mussel No. 2, . . .	—	No <i>Coli</i> from 50 c.c., . . .	—	No note of these results.
Water from same place, . . .	—	Typical <i>Coli</i> from 50 grams, . . .	+	
Mud „ „ . . .	+			
IV. Phibbs' Layings.				
Oyster No. 1, . . .	—	Phenol-broth turbid, but no <i>Coli</i> on plate.	—	A little serum beneath cream; no gas.
„ No. 2, . . .	—	Phenol-broth sterile, . . .	+	0.25 c.c. juice only used; result atypical.
„ No. 3, . . .	—	„ (0.5 c.c. juice), . . .	—	
„ No. 4, . . .	—	Phenol-broth became turbid, but no <i>Coli</i> on plate (0.5 c.c. juice used).	+	Result typical, though only 0.16 c.c. juice was available for inseminating milk-tube.
„ No. 5, . . .	—	„ (1 c.c. juice), . . .	+	Result typical with 0.5 c.c. juice.
„ No. 6, . . .	+	Aerogenes-like colonies obtained which proved typical <i>Coli</i> on all substrata save potato.	—	Milk unchanged (1 c.c. juice used).
Water from same place, . . .	—	No <i>Coli</i> in 50 c.c., . . .	—	
Mud „ „ . . .	+	Typical <i>Coli</i> from 50 grams, . . .	+	
V. Cochrane's Layings. [29-5-03].				
Oyster No. 1, . . .	—	Phenol broth remained sterile.	—	Typical change.
„ No. 2, . . .	—		—	
„ No. 3, . . .	—		+	
„ No. 4, . . .	—		+	
Water from same place, . . .	—	Streptococci developed in broth when 50 c.c. material was used.	—	
Mud „ „ . . .	—	Cocci only developed in phenol-broth. (50 grams used).	+	Typical change.
VI. Crichton's Layings. [29-5-03].				
Oyster No. 1, . . .	—	Phenol-broth sterile.	—	Atypical coagulation.
„ No. 2, . . .	+	Filmy <i>Coli</i> typical in all respects.	—	
„ No. 3, . . .	—	Phenol-broth turbid; colonies on plate resembled <i>aerogenes</i> var. of <i>Coli</i> , but microscopically found to be diplococci; subculture at 37° failed.	—	Same result.
„ No. 4, . . .	—	Doubtful coli-form colony, . . .	—	Unchanged
„ No. 5, . . .	—	Phenol-broth turbid but no typical coli-form on plate.	—	
„ No. 6, . . .	+	Typical <i>Coli</i> , . . .	—	
Water from same place, . . .	—	No <i>Coli</i> from 50 c.c., . . .	—	
Mud „ „ . . .	—	„ 50 grams, . . .	+	

+ signifies that the organism tested for was found.

— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
VII. Verschoyle's Layings, [29.5.03].				
Oyster No. 1,	—	Phenol-broth sterile,	—	Atypical change.
" No. 2,	—	No coli-form colonies on plate,	+	
" No. 3,	—	Same result,	—	
" No. 4,	—	} Phenol-broth sterile,	—	
" No. 5,	—		—	
" No. 6,	—	No coli-form colonies on plate,	—	
Mussel No. 1,	—	} Phenol-broth remained sterile,	+	Typical change.
" No. 2,	—		—	Atypical.
" No. 3,	—		—	Atypical, no gas.
Cockle No. 1,	—	} Typical filmy <i>Coli</i> ,	—	} Typical change.
" No. 2,	+		+	
" No. 3,	+		+	
Water from same place,	+	Typical filmy <i>Coli</i> obtained from 1 c.c. After a few days in the refrigerator it could not be obtained from 50 c.c.	+	
Mud " "	—	<i>Coli</i> not found even in 50 grams.	+	Typical change.
VIII. Baker's Layings [1.6.03].				
Oyster No. 1,	—	Streptococci only from the turbid phenol-broth.	+	} Typical change in all.
" No. 2,	+	Typical <i>Coli</i> ,	+	
" No. 3,	+	" " "	+	
" No. 4,	+	" " "	+	
" No. 5,	+?	Somewhat abnormal in litmus-lactose and neutral red-media, Yellowish Cocci,	+	
" No. 6,	—	<i>Coli</i> from 50 not from 1 c.c., type of colony intermediate between the filmy and the discoid form.	+	
Water from same place,	+		+	
Mud " "	+	<i>Coli</i> from 50 grams, but not from a knife-pointful.	+	
IX. Kempt's Layings, Sligo Bay [1.6.03].				
Oyster No. 1,	—	Phenol-broth sterile,	+	} Typical change.
" No. 2,	+	Both vars. of <i>Coli</i> ,	+	
" No. 3,	+	Same result,	+	
" No. 4,	+	" " "	+	} Typical change.
" No. 5,	+	" Vine-leaf" form pure,	—	
" No. 6,	+	Same + a few small <i>aerogenes</i> cols.	+	
Water from same place,	+	Typical <i>Coli</i> both in 1 c.c. and in 50 c.c.	+	
Mud " "	—	<i>Coli</i> not found either in a knife-pointful or in 50 grams.	+	
X. Sir J. Gore-Booth's Layings, Drumcliffe Bay [2.6.03].				
Oyster (the only one),	—	First plate liquefied and duplicated with negative result.	+	Typical.
Mussel No. 1,	—	Liquefying colonies only,	—	Unchanged.
" No. 2,	—	Same result,	—	A little serum on top.
" No. 3,	? +	Pseudo-coli,	—	Partly coagulated; no gas.
" No. 4,	—	Phenol-broth sterile,	—	Converted into translucent serum, but no gas.
Water from same place,	—		—	Unchanged.
Mud " "	—		+	Typical.

COAST OF COUNTY OF DONEGAL.

LOUGH SWILLY.

From the public oyster beds here, I received six oysters for examination together with the usual samples of mud and water. The result of the examination was that *pseudo-Coli* organisms were detected in two of the oysters—curiously enough the same two distinct varieties in each. One of these varieties was absolutely indistinguishable from the genuine veil-like or *filmy Coli* on the gelatine plate. The other was harder and came away like a scale on the inoculation needle. Neither variety grew well at 37° nor produced the typical changes in litmus-lactose or neutral-red-agar. They formed indol, and three out of the four subcultures “bubbled” even ordinary gelatine. These organisms must be unhesitatingly rejected from the denomination true *Coli*, and the layings must accordingly pass as uncontaminated by sewage.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
Public Beds, Lough Swilly, [26-5-03].				
Oyster No. 1, . . .	—	Plate remained almost sterile,	+	
„ No. 2, . . .	—	Two different sorts of coli-form colonies obtained on plate, but neither stood all the tests.	+	
„ No. 3, . . .	—	Very similar colonies on the plate: had to be rejected for same reasons.	—	Atypical.
„ No. 4, . . .	—	Plate remained sterile, .	—	Unchanged ($\frac{1}{2}$ c.c., only used).
„ No. 5, . . .	—	Plate produced one <i>Proteus</i> , .		
„ No. 6, . . .	—	Phenol-broth did not develop,	?	Tube accidentally broken.
Water from same place, . . .	—		?	
Mud „ „ „ . . .	—	Cocci only, . . .	?	

COASTS OF COUNTIES OF DONEGAL AND LONDONDERRY.

LOUGH FOYLE.

Specimens from Quigley's Point were sent in two separate consignments, one containing cockles and a mussel, the other oysters. One cockle and one oyster yielded typical *Coli*, whilst *Enteritidis* was found in 10 out of 14 specimens examined. It would therefore appear that these layings are subject to a small amount of sewage contamination.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
I. Cockles from Quigley's Point.				
Cockle No. 1, . . .	—	Only a <i>Proteus</i> colony on plate,	—	Atypical — stratified appearance.
„ No. 2, . . .	—	Phenol-broth remained clear,	+	} Typical change.
„ No. 3, . . .	+	Typical <i>Coli</i> (2 strains isolated.)	+	
„ No. 4, . . .	—	Phenol-broth remained clear,	+	} Atypical; clot too solid.
„ No. 5, . . .	—	Only streptococci obtained, .	—	
Mussel from same place, . . .	—	Similar result—gelatine liquefied by the Cocci.	—	Unchanged.
Water, „ „ . . .	—	Only liquefying cols. on plate (50 c.c. sample used.)	—	„
Mud, „ „ . . .	—	„ „	+	Typical change.

+ signifies that the organism tested for was found.

— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
II. Public Beds (per John Crosson, Quigley's Point). [26. 5. 03].				
Oyster No. 1, . . .	—	Phenol-broth remained clear ($\frac{1}{2}$ c.c. juice only used.)	+	(Piece of oyster used.)
„ No. 2, . . .	—	No coli-form colonies on plate (no juice obtainable; piece of mollusc used.)	+	„ „
„ No. 3, . . .	+	Typical <i>Coli</i> , . . .	+	
„ No. 4, . . .	—	$\frac{1}{2}$ c.c. only obtainable—phenol-broth clear.	+	$\frac{1}{2}$ c.c. juice only used.
„ No. 5, . . .	—	Phenol-broth sterile, . . .	+	
„ No. 6, . . .	—	No coli-form colonies on plate (piece of oyster used—no juice obtainable.)	+	(Oyster itself used; no juice obtainable.)

COASTS OF COUNTIES OF ANTRIM AND DOWN.

Material was collected about the 21st of May, 1903, and forwarded to me from the following inlets:—Belfast Lough, Strangford Lough, and Dundrum Creek. From the six cockles, mud, and water received from the last-named locality, not a single positive result for *Coli* was obtained. On the other hand, *Enteritidis* was found in five out of the six cockles and in the mud, but not in the water.

The same amount of material from Strangford Lough (taken at a point two miles below Newtownards) was subjected to similar tests with a like result. No *Coli* was detected in any of the specimens, whereas *Enteritidis* was quite widely diffused.

Dr. Browne also took material from four different localities on the shore of Belfast Lough, viz:—the Strand opposite Tillysburn on the south side of the Lough (6 cockles, mud and water); a point close to Lighthouse No. 1 (4 oysters, mud and water); a point opposite Greencastle (6 cockles, mud and water); and, finally, 3 oysters from Grey Point. The result of the Examination was that *Coli* was detected in two of the Greencastle cockles as well as in the water from that place, and in two of the Tillysburn cockles. On the other hand, the oysters from near Lighthouse No 1 and from Grey Point proved free from that organism. With regard to *Enteritidis* all that need be said here is, that its distribution was found, as usual, to be quite extensive, very few of the samples being without it. It was found quite as often in the *Coli*-free specimens as in those that contained that organism.

The result, then, of the bacterioscopic test would appear to be that whereas it yields no evidence of sewage pollution of the shell-fish collected in Dundrum Creek and Strangford Lough, it does give support to the view which is *à priori* probable, that the shell-fish from the shore of Belfast Lough are liable to that form of contamination.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
I. Cockles from opposite Greencastle, Belfast Lough.				
Cockle No. 1, . . .	—	Gas-forming anaerobes + streptococci.	+	Typical change in all.
" No. 2, . . .	—	" "	+	
" No. 3, . . .	—	" "	+	
" No. 4, . . .	+	Typical "Vine-leaf" <i>Coli</i> , .	+	
" No. 5, . . .	+	Typical <i>Coli</i> of <i>aerogenes</i> character.	+	
" No. 6, . . .	—	Anaerobes and Cocci, .	+	1 c.c. gave typical result.
Water from same place, .	+	50 c.c. examined; the plate yielded only one very doubtfully coli-form colony, which was subcultured and gave all the reactions.	+	
Mud " " . . .	—	25 grams examined yielded gas-forming anaerobes only.	+	Typical result.
II. Cockles from Strand opposite Tillysburn, Belfast Lough, South Side.				
Cockle No. 1, . . .	+	Typical filmy <i>Coli</i> obtained (streptococci also).	+	Typical result in all.
" No. 2, . . .	—	Liquefying streptococcus colonies only.	+	
" No. 3, . . .	—	Phenol-broth remained sterile.	+	
" No. 4, . . .	+	<i>Coli</i> of both filmy and <i>aerogenes</i> character on plate.	+	
" No. 5, . . .	—	Streptococci + anaerobes, .	+	
" No. 6, . . .	—	Phenol-broth turbid from reproductive bodies of cockle.	+	Test applied to 1 c.c.
Water from same place, .	—	50 c.c. used with negative result.	—	
Mud " " . . .	—	25 grams tested with negative result.	+	A knife-pointful used with positive result.
III. Oysters from close to Lighthouse No. 1, Belfast Lough.				
Oyster No. 1, . . .	—	Phenol-broth remained sterile,	+	Typical change in all.
" No. 2, . . .	—	" "	+	
" No. 3, . . .	—	" "	+	
" No. 4, . . .	—	" "	+	
Water from same place, .	—	Motile anaerobes in phenol-broth. Only cocci grew on plate. (50 c.c. sample used).	—	1 c.c. used, no change.
Mud " " . . .	—	Some <i>aerogenes</i> -like colonies developed, but the subculture died out. Evidently not <i>Coli</i> . (25 grams sample used.)	+	Knife-pointful used, result typical.
IV. Grey Point, Belfast Lough.				
3 Oysters sent.				
Oyster No. 1, . . .	—	$\frac{1}{2}$ c.c. juice only obtainable for this test.	—	Litmus milk bleached, but not coagulated. ($\frac{1}{4}$ c.c. juice used.)
" No. 2, . . .	—	None of these tubes showed development.	+	Typical result.
" No. 3, . . .	—	$\frac{1}{4}$ c.c. juice only obtainable for this test.	—	Litmus milk changed to a dirty yellow slimy material. ($\frac{1}{4}$ c.c. only used).

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
V. Cockles from Strangford Lough, 2 miles below Newtownards.				
Cockle No. 1, . . .	—	Gas-forming anaerobes in phenol-broth.	—	Dirty-yellowish-brown, slimy coagulum; no gas.
" No. 2, . . .	—	Phenol-broth sterile.	—	"
" No. 3, . . .	—	" " "	+	Typical change.
" No. 4, . . .	—	Gas-forming anaerobes in phenol-broth.	+	"
" No. 5, . . .	—	Phenol-broth sterile.	+	"
" No. 6, . . .	—	Gas-forming anaerobes in phenol-broth.	+	"
Water from same place, . . .	—	50 c.c. tested; only liquefying colonies developed.	—	No change (with 1 c.c.).
Mud " , , . . .	—	About 25 grams tested; only anaerobes developed.	+	Typical change (with knife-pointful).
VI. Cockles from Dundrum Creek, Co. Down.				
Cockle No. 1, . . .	—	Gas-forming anaerobes and streptococci in phenol-broth.	—	Dirty-yellowish-brown, slimy coagulum; no gas.
" No. 2, . . .	—	"	+	Typical change.
" No. 3, . . .	—	"	+	
" No. 4, . . .	—	"	+	
" No. 5, . . .	—	"	+	
" No. 6, . . .	—	"	+	Typical change.
Water from same place, . . .	—	" (50 c.c. tested).	—	No change (with 1 c.c.).
Mud " , , . . .	—	" (25 grams tested)	+	Typical change (with knife-pointful).

COASTS OF COUNTIES OF DOWN AND LOUTH.

CARLINGFORD LOUGH.

From ten different localities in this region material was forwarded to me and examined with the results set forth in the appended statement The following layings did not yield a single positive result for *Coli* :—Mussen's opposite Ballyonan; Public oyster beds near Ballyonan; Mussen's at Drummullagh; Public oyster beds between Narrow Water and Warrenpoint; Public oyster beds opposite Rostrevor; and Public oyster beds half a mile from Warrenpoint. Not one of the six oysters from McDonald's laying in the Newry River, above Narrow Water Ferry, gave a positive result, though *Coli* was detected in as little as 1 c.c. of the water. (A week afterwards, the sample having been kept meanwhile at 3°C., in the refrigerator, it could not be found in 50 c.c.).

On the other hand, the material from the following layings proved to be more or less extensively contaminated :—Hardy's (two certain, and one highly probable result out of 6 oysters, positive results for water and mud); and Petrie's (*Coli* in two out of 6 oysters).

Three of the layings (Nos. 2, 3, and 5) did not furnish a single oyster containing *Coli*, nor a single oyster that did not contain *Enteritidis*. Can it be that in this particular locality conditions prevail (? factory effluents), which are specifically unfavourable to the persistence of *Coli*? If so, these conditions must be inoperative at the layings known as Hardy's and Petrie's. At first sight one might be inclined to suppose that we were here confronted with the relatively simple case of the prevalence of conditions unfavourable to non-sporing forms generally. But this supposition is negated by the demonstration of streptococci in oysters, soil, and water, from every one of the localities examined. Now, streptococci are admittedly delicate organisms. Nor can we suppose that the shell-fish from Carlingford exercise an unusually powerful phagocytic action upon *B. coli*, for if this were so, the elimination of the material other than shell fish would affect the percentages, which is not the case. Possibly the sewage of Newry is subject to conditions specifically antagonistic to the persistence of *B. coli*, and the presence of that organism in certain beds is to be attributed to purely local circumstances, such as drainage from neighbouring houses. Finally, we may,

perhaps, suppose that the sewage of Newry fails for some reason to reach those beds from which *Coli* was absent. In view of the almost universal diffusion of *B. enteritidis*, this supposition does not however recommend itself to my mind.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
I. Mussen's O. B., opposite Ballyonan House, one mile E. of Omeath (11-5-03.)		Clean-looking plump oysters, medium to small; greenish tinge in many.		
Oyster No. 1, . . .	—	Gram-staining, liquefying streptococcus producing "nucleated" colonies.	—	Litmus milk bleached and partly coagulated.
" No. 2, . . .	—	" " "	+	Typical change.
" No. 3, . . .	—	Phenol-broth remained sterile,	—	Cream blue, whey yellow, no gas.
" No. 4, . . .	—	Cocci, " " "	+	Typical change.
" No. 5, . . .	—	Streptococci, same as No. 1, .	+	"
" No. 6, . . .	—	Phenol-broth sterile. 50 c.c. also tested with similar result.	—	"
Water from same place, .	—		—	Cream blue, whey clear, no gas.
Mud " " .	—	Same streptococci as No. 1 (whole sample subsequently tested with similar result).	+	Typical change.
II. Foreshore near Ballyonan House.—Public O. B. (Five Mussels from here sent at same time—11-5-03—were not examined).		Very small thin oysters.		
Oyster No. 1, . . .	—	Phenol-broth remained sterile,	+	
" No. 2, . . .	—	Streptococci, same as Mussen's No. 1.	+	
" No. 3, . . .	—	Phenol-broth sterile,	+	
" No. 4, . . .	—	Streptococci, same as Mussen's No. 1.	+	
" No. 5, . . .	—	Phenol-broth sterile,	+	
" No. 6, . . .	—	" " "	+	Change not perfectly typical, but due to the true <i>B. enteritidis sporogenes</i> .
Water from same place, .	—	Phenol-broth sterile (on testing 50 c.c., cocci only grew).	+	
Mud " " .	—	Streptococci, same as Mussen's No. 1; the minute cols. on plate presented under low power a close resemblance to squamous epithelial cells, (same cocci on testing entire sample).	+	
III. Mussen's Beds at Drum-mullagh, near Omeath, opposite Warrenpoint (low water, 12-5-03). (8 mussels sent from here were not examined).		Fine plump oysters.		
Oyster No. 1, . . .	—	Phenol-broth sterile,	+	} Typical change in all.
" No. 2, . . .	—	" " "	+	
" No. 3, . . .	—	Gram-staining bacilli, forming yellow sunk-in cols. on gelatine.	+	
" No. 4, . . .	—	The "nucleated" streptococcus,	+	
" No. 5, . . .	—	Phenol-broth sterile,	+	
" No. 6, . . .	—	" " "	+	
Water from same place, .	—	Phenol-broth sterile (streptococci on testing 50 c.c.)	+	
Mud " " " .	—	The "nucleated" streptococcus. (On testing whole sample, coliform colonies appeared on plate, but did not grow in broth at 37°, hence not <i>Coli</i>).	+	

+ signifies that the organism tested for was found.

— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
IV. Public Beds between Narrow Water and Warrenpoint, Newry River. (12-5-03).		Large plump oysters, long shape, like Portuguese.		
Oyster No. 1, . . .	—	The "nucleated" streptococcus,	+	Typical change.
" No. 2, . . .	—	Phenol-broth sterile, .	—	Litmus milk unchanged.
" No. 3, . . .	—	" " " .	—	" " "
" No. 4, . . .	—	" " " .	+	
" No. 5, . . .	—	" " " .	—	Litmus milk bleached.
" No. 6, . . .	—	" " " .	+	Typical change.
Water from same place, .	—	Phenol-broth sterile (streptococci on testing 50 c.c.)	—	Litmus milk unchanged.
Mud " " " .	—	Objectionable smell — "nucleated" streptococcus. (Same result on testing whole sample).	+	Typical change.
V. McDonald's Beds, Newry River, above Narrow Water Ferry. (13-5-03).				
Oyster No. 1, . . .	—	The "nucleated" streptococcus,	+	} Typical change in all.
" No. 2, . . .	—	Phenol-broth sterile, .	+	
" No. 3, . . .	—	" " " .	+	
" No. 4, . . .	—	" " " .	+	
" No. 5, . . .	—	" " " .	+	
" No. 6, . . .	—	" " " .	+	
Water from same place, .	+	Thick var. of <i>Coli</i> —motile. Stood all tests. (50 c.c. sample subsequently tested gave only cocci—abnormal result).		Milk tube accidentally broken.
Mud " " " .	—	The "nucleated" streptococcus (the same organism only found on testing whole of sample.)	+	Typical change.
VI. Hardy's Bed, Newry River, (13-5-03).		Large plump oysters, resembling those known as "Portuguese."		
Oyster No. 1, . . .	—	Phenol-broth sterile, .	+	} Typical change in all.
" No. 2, . . .	—	" " " .	+	
" No. 3, . . .	+	Typical <i>Coli</i> , filmy variety, .	+	
" No. 4, . . .	+	Weak fermenter of lactose, produced but little indol, no growth visible on potato.	+	
" No. 5, . . .	+	This strain of <i>Coli</i> formed nitrite as well as indol.	+	
" No. 6, . . .	—	Phenol-broth sterile, .	+	
Water from same place, .	+	Typical <i>Coli</i> , thin variety (on subsequent testing of 50 c.c. only cocci grew—abnormal result.)	—	Cream bleached; below it 2.5 cm. of turbid yellow whey, at bottom 3.5 cm. blue unaltered milk; appearance very peculiar.
Mud " " " .	+	Streptococci only in the loop-inoculation; on subsequent testing of the whole of the sample, genuine <i>Coli</i> developed.	+	Typical change.

+ signifies that the organism tested for was found.
 — signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
I. Bellurgan Cockle-Strand. Specimens sent by Dr. Finegan of Carlingford. (24-5-03),		Cockles suspected by Dr. Edgar Flinn of being con- cerned in several outbreaks of typhoid. (Specimens sent up at his request three years ago yielded negative result for typhoid).		
Cockle No. 1, . . .	+	Typical <i>Coli</i> of both varieties,	+	} Typical change in all.
„ No. 2, . . .	+	Typical <i>Coli</i> of both varieties, both rather weak indol-for- mers.	+	
„ No. 3, . . .	+	Both vars. of <i>Coli</i> , one a rather weak indol-producer.	+	
„ No. 4, . . .	—	Phenol-broth sterile,	+	
„ No. 5, . . .	+	Typical <i>Coli</i> of both varieties,	+	
„ No. 6, . . .	+	„ „ „	+	
Water from same place,	—	Bacilli appeared in phenol- broth, but did not grow on plate ? over-diluted. 50 c.c. tested.	—	
Mud „ „	+	Whole sample tested,	+	Typical change.
II. River Boyne, opposite Bal- tray and Mornington Vil- lages, about 3 miles below Drogheda. (7-5-03.)				
Mussel No. 1, . . .	+	Typical filmy <i>coli</i> , . . .	+	Typical change.
„ No. 2, . . .	+	„ „ + strepto- cocci.	—	Bleached ; solid coagulum.
„ No. 3, . . .	+	„ „ pure,	+	Typical change.
Water from same place,	+	Both filmy and opaque <i>coli</i> , .	+ ?	Coagulum a little too solid.
Mud „ „	—	Streptococci only, white, non- liquefying.	+	Typical change.
III. Strand, Dundalk Bay, oppo- site Blackrock. (8-5-03.)				
Cockle No. 1, . . .	—	Phenol-broth sterile, . . .	+	Typical change.
„ No. 2, . . .	—	Cocci only, . . .	+	„ „
„ No. 3, . . .	—	Phenol-broth sterile, . . .	—	Bleached.
IV. Dundalk River, oppo- site "Soldier's Point." (8-5-03.) (At half-ebb- tide.)				
Mussel No. 1, . . .	+	Typical filmy <i>coli</i> , . . .	+	} Typical change in all.
„ No. 2, . . .	+	Both filmy and opaque vars. of <i>coli</i> .	+	
„ No. 3, . . .	+	Typical filmy <i>coli</i> , . . .	+	
Water from same place,	+	Both filmy and opaque vars. of <i>coli</i> .	+	
Mud „ „	—	Streptococci, white, non-lique- fying.	+	
V. Ballymacscanlon Bridge, Dundalk River. (8-5-03.)				
Mussel No. 1, . . .	+	Typical filmy <i>coli</i> , . . .	+	Typical change.
„ No. 2, . . .	+	„ „ „	+ ?	Clot a little solid.
„ No. 3, . . .	—	Phenol-broth sterile, . . .	—	Bleached.

COAST OF COUNTY OF DUBLIN.

DUBLIN BAY AND VICINITY.

My first report* on this subject took the form of a letter addressed on March 13th, 1903, to the Local Government Board, who communicated it to the Public Health Committee of the Dublin Corporation on March 19th, together with Dr. Edgar Flinn's report on the results of his own inspection of the layings. Both reports were handed to the representatives of the Press who attended the meeting of the Committee on the 31st March, and appeared in the Dublin newspapers of the following day. I now proceed to communicate in detail the investigations referred to in that letter. In order to avoid unnecessary repetition, I have already described, under the head of "General Observations," the methods of procedure, nutrient *substrata*, quantities of material operated on, and other details indispensable for the comparison of my results with those attained by other workers in the same field. Departures from the usual procedure will be notified in the "Remarks Column" of the Tabulated Statement subjoined. In the following pages I propose to confine myself to giving an account of the several specimens examined and of the results obtained.

Clontarf. First
Examination.

My first visit to the Clontarf layings was made in company with Dr. Edgar Flinn on January 22nd, 1903. The first samples we collected on that occasion were two American "Blue-point" oysters, which had lain some months on the beds, and were amongst those in the act of being removed on a cart for disposal through the usual channels. In dealing with these and the other samples collected on the same occasion, the examination made took the form of ascertaining the numerical germ-content of the mingled oyster-juice and shell-water, whilst the characters of the several colonies that developed on the plates were carefully noted. *B. coli* was also tested for in each case by the phenol-broth method. The result of the plate cultures made from these two oysters was closely accordant, corresponding to a germ-content of about 10,000 germs per cubic centimetre of fluid. The largest colonies on each plate were, as usual, in such specimens, of the *Proteus* and *Fluorescens* type. The minuter colonies were mostly cocci. The plates also showed some doubtfully coli-form colonies which were not subcultured, as the phenol-broth method had already yielded positive results. The general aspect of the plate-cultures was strongly suggestive of sewage, as may be seen from photograph (Plate I., fig. 4). The phenol-broth tube made from each oyster gave positive results, typical *B. coli*, forming colonies of vine-leaf (preferably termed "filmy") pattern, being isolated therefrom and complying with the necessary tests.

The second group of samples comprised six "East River" oysters, laid down two months previously. Two of these were used for plate-culture, and four for phenol-broth tubes.

Oyster 1.—Germ-content 2,000 per c.c., about one-tenth of which were large liquefying colonies. There were typical coli-form colonies also on the plate.

Oyster 2.—Here the colonies were fewer, working out at about 1,000 per c.c., but the character of most of them was pronouncedly liquefying, so that they rapidly became confluent, and destroyed the plate. Before this occurred, however, it was possible to detect and subculture several small coli-form colonies of *aerogenes* type. The appearance of this plate, when four days old, is reproduced on Plate I., fig. 5.

Oyster 3.—From this and the following specimens only the phenol-broth tube was done. It yielded coli-form colonies of filmy texture (which proved to be genuine), together with some more opaque, discoid, not fringed, and therefore quite suggestive of *aerogenes*, were it not that they gradually liquefied the gelatine. This property would be regarded by most workers as at once justifying their removal from the denomination *B. coli*. In their luxuriant growth on phenolated-broth, as well as in their behaviour towards the several sugars, potato, milk, neutral red, and in their abundant formation of indol, the

* See page 76.

colonies agreed with the typical *Colon bacillus*, and one would be inclined to suggest for this organism the name, *B. coli liquefaciens*. Similar organisms have been encountered by Dr. Klein.

Oysters 4, 5, and 6 yielded typical coli-form colonies of either or both types, which stood the tests and were shown to be genuine *Coli*.

Group 3.—“East Rivers,” laid down ten months previously. Six of these were collected, of which two were used for plates and the other four tested by the phenol-broth method. The result did not materially differ from that arrived at in the case of the last group. The germ-content was found to be about 1,000, and 1,500 respectively, whilst coli-form colonies appeared on both plates, and were obtained from all the phenol-broth tubes.

Group 4 consisted of a few living specimens picked by ourselves out of a great accumulation of dead oysters and shells on the Clontarf foreshore, close to the layings. Five of these were tested. The germ-content of two of them was found to be approximately 3,000 per c.c. The appearance of the plates was slightly different from that of the previous samples owing to the presence of colonies of a common mould (*Mucor*), and of a peculiar cloudy colony resembling those described by Frankland as *B. nubilus*. All these specimens yielded *B. coli*.

Group 5.—This consisted of four oysters from the most inland part of the layings, and therefore nearest to the sewer-outfalls.

Specimens 1 and 2 were plated out and yielded about 2,000 colonies per c.c., including the ordinary saprophytes, together with coli-form colonies. The other two yielded genuine *Coli* on being tested by the phenol-broth method.

Group 6 comprised three oysters from a point still further inland than that at which Group 5 was taken, and quite beyond the confines of the layings. They were old specimens that had been a long time laid down—some three years, as we were assured in the case of No. 1, which was a very large, thick-shelled oyster. They had reached their present position through being washed up during gales. How long they had been there it was impossible to say.

Oyster 1—the very large specimen—proved to have a germ-content of about 1,000 per c.c. The plate bore a large and beautiful colony of *B. figurans*. Coli-form colonies were present, but fewer than in most of the previous plates. Oysters two and three yielded genuine *B. coli* by the phenol-broth method.

Group 7 comprised six cockles found lying on the surface of the foreshore, within a few yards of a sewer-outfall, but not in a line with it. How they came to be above the surface of the sand is not clear. I am not aware that these molluscs are liable to be brought to the surface by storms. Possibly they may have been dropped there by some cockle-merchant or been gathered by a child and thrown away again. One of them was plated-out and found to contain approximately 1,000 germs per cubic centimetre of body-fluid. Quite a large proportion of these was typically coli-form, and one of them was found to stand the tests. The four remaining cockles were tested by the phenol-broth method, but only one of them—No. 3—yielded *Coli*. The others failed to give rise to turbidity in the broth—possibly because the quantity of material available for inoculating them was too small (a few drops), possibly because they had come from less contaminated surroundings.

The results in the above series were controlled by a parallel series of cultures, made both on gelatine-plates and in Parietti-tubes, from a sample of tap-water, artificially infected with a loopful of putrescent human faeces. The coli-form colonies that appeared on the original plates and on those obtained by plating out the turbid phenol-broth tubes, were carefully compared with those obtained from the oysters by identical methods, and their close similarity established beyond a doubt. Some strains of *Coli*, isolated

from the fæces, were put through the several confirmatory tests at the same time as those derived from the shell-fish and their behaviour found to be identical.

The remarkable uniformity of these results—if we leave the cockles out of consideration for a moment—led me to form the opinion that the molluscs on these layings were subject to profound and widespread contamination with matters of excretal origin, and, having, in the meantime, convinced myself by the examination of several batches of oysters from layings along the West Coast, procured by myself from merchants in the city, that the *Colon bacillus* is not a normal inhabitant of the oyster, I thought it my duty to make an *ad interim* report to the Local Government Board, in the hope that steps might be taken to safeguard the public from a possible source of danger. What took place has been already stated. The subject attracted considerable attention at the time, and, I understand that the lessees of the layings were notified that their occupancy would have to terminate. Whether the practice of fattening oysters on these gravely polluted layings has actually been discontinued I do not know.

Clontarf. Second
Examination.

In the subsequent examinations of material from the shores of Dublin Bay, I modified the procedure in the following points:—

1. By omitting the gelatine-plate-culture of the oyster-fluid, the utility of this, from the special point of view of the analysis, being very doubtful;
2. By adding the test for *B. enteritidis sporogenes* (Klein); and
3. By the introduction, in a few instances, of a quantitative test for the organisms in question.

In accordance with this plan, I examined the following materials collected by myself, conjointly with Dr. Edgar Flinn, during a visit which we paid to the layings on April 10th, 1903.

Group 1.—Very large coarse oysters, of the description known as “North Sea” oysters (three collected).

Group 2.—Rather small oysters, described as “from Cork” (three collected).

Group 3.—Medium-sized oysters, described as “Carlingfords” (three collected). Immediately after arrival at the Laboratory, and within two hours of collection, the largest of the three oysters comprising each group was selected, opened with the usual precautions, and all that could be obtained of the body-juices and shell-water transferred to a sterile test-tube, and well mixed by shaking. With this fluid a series of dilutions in phenolated-broth were prepared, so that the first tube received 1 c.c. of the liquid, the second 0·1 c.c., the third 0·01 c.c., the fourth 0·001 c.c., and the fifth 0·0001 c.c. The only variant in each tube was the amount of oyster-fluid, the total bulk of liquid, and the percentage of phenol remaining the same. All were put away at 37° C.

Next day, the first two tubes of the “North Sea” series, the first two of the “Cork” series, and the first three of the “Carlingford” series showed development. After two days had elapsed, the third of the “North Sea” series became turbid. None of the others underwent change, though observed for several days. On plating-out the turbid broth-tubes, the 1 c.c. tube of the North Sea series yielded coli-form colonies of typical filmy, and also of *aerogenes* pattern. The 0·1 c.c. tube yielded the filmy variety only, whilst the 0·01 c.c. tube yielded the *aerogenes* variety in a pure state. On each plate were some colonies of cocci. (See Plate I., fig. 6, A, B, and C.)

The 1 c.c. and 0·1 c.c. tubes of the “Cork” oyster series yielded typical coli-form colonies of the filmy pattern, intermixed, in the case of the former, with coccus colonies, absolutely pure in the case of the latter (Plate I., fig. 7, G). The former also produced a large liquefying colony which was threatening to destroy the whole plate at the time the photograph was taken (Plate I., fig. 6, F).

The first three tubes of the “Carlingford” oyster series also yielded coli-form colonies on the plates, as may be seen by referring to Plate I., fig. 7

where K shows the result of plating-out the 1 c.c., L the 0·1 c.c., and M the 0·01 c.c. tube respectively. K and L show coli-form colonies of the filmy type, and M colonies of the *aerogenes* variety. The colony selected for sub-culture may be recognised by the track of the inoculating-needle.

From the above experiment it would appear that the "North Sea" and "Carlingford" oysters examined, contained in each cubic centimetre of their mingled body-juice and shell-water, at least 100 and less than 1,000 living germs of *Bacillus coli*, whilst in the "Cork" oyster the number present per cubic centimetre was at least ten, but less than 100 individuals of *Coli*. It would have been interesting, and, perhaps, useful, to have applied the quantitative method to a large number of specimens from different sources; but on account of the very large number of specimens sent in at once, this could not be undertaken.

The two remaining oysters of each group were tested as usual, 1 c.c. of mingled juice and shell-water being operated on. All six yielded positive results. The two "North Sea" oysters gave the result reproduced on Plate I., fig. 9, A1 and A2. The former bears coli-form colonies of the *aerogenes* type, together with one large colony of filmy pattern, in which the track of the sub-culture-needle can be seen. In the latter, A 2, the colonies are of the filmy pattern, and exhibit a progressive increase in size from the centre towards the periphery, where there is more space and the layer of gelatine is deeper. The one selected for sub-culture and study can be recognised by the needle-mark. It lies at the periphery, and is the next colony but one, below the left-hand end of the horizontal diameter. Minute coccus colonies appear on both plates. In the case of the two remaining so-called "Cork" oysters, the results of plating-out the turbid phenol-broth tubes can be seen on Plate I., fig. 8, B1 and B2; whilst the results in the case of the two remaining "Carlingford" oysters are in the same figure (C1 and C2). The two former present a mixture in varying proportions of two varieties, "filmy" and "*aerogenes*" of *Coli*, whilst in the two latter the filmy variety is alone represented, intermixed with a few minute coccus colonies.

All nine oysters collected on this occasion were thus shown to contain *B. coli communis*.

Turning now to the presence of *B. enteritidis sporogenes*, quantitative tests were applied to the same three oysters as in the case of *B. coli*; owing, however, to an unfortunate omission in writing up the notes, I am not in a position to make any statement of results further than that the first (1·0 c.c.) tube of each series displayed the typical change. The two remaining oysters of each group were also tested for this organism as usual, and the results need not be detailed in this place; they will be found in the tabulated statement.

On the same occasion, samples of the water and ground-formation of the Clontarf layings were collected. Water No. 1 was collected from a clean-looking pool that had been left in the middle of the layings by the receding tide. Sample No. 2 was taken at the furthest point of the layings that could be reached dry-shod, where the returning tide was beginning to submerge them. The water here was dirty-looking, with patches of a thin greyish scum floating on the surface. The current was not advancing from the direction of the open sea, but from the westerly direction, that is, from the mouth of the Liffey. To both of these samples of water the quantitative method was applied, the dilutions ranging from 1·0 to 0·0001 c.c. In the case of Sample 1, the result was doubtful, some disturbing element having evidently entered into the experiment. After one day in the incubator, all the five broth-tubes, remained clear. At the end of the second day the first and third tubes, containing respectively 1·0 and 0·01 c.c. sample, showed development, but not the intervening (0·1 c.c.) one. The result of plating out the 1·0 c.c. tube is seen on Plate II., fig. 1, at W1a. It yielded no coli-form colonies, only cocci. In the case of the 0·01 c.c. tube, the result of plating-out which is seen on the same figure at W1c, the preliminary dilution has evidently been pushed too far. Only three colonies of different sizes and characters, appear on the plate. The largest was very doubtfully

coli-form. It was sub-cultured, as may be seen from the needle-mark, and behaved typically on some of the test-media, but its growth in milk and neutral-red-agar-shake precluded its being ranked with genuine *Coli*. This water must therefore be passed as free from *Coli* in 1 cc. The result in the case of Sample 2 was very different. The first two tubes of its series became turbid, and on being plated-out produced the appearance seen in the illustration (Plate II., fig. 1, W2a and W2b), which shows exquisitely filmy coli-form colonies of *bizarre* shapes. It would therefore appear that whereas the water taken from a pool in the middle of the layings was not shown to contain *Coli*, the incoming tide would appear to have been, on the occasion of the examination at any rate, carrying with it individuals of that species to the number of at least 10, but less than 100, per cubic centimetre.

The result as regards *B. enteritidis sporogenes* was negative in the case of both water-samples. Dilutions varying from 1·0 to 0·0001 c.c. were made of both. The higher dilutions underwent no change. The 1·0 and 0·1 c.c. tubes became bleached, and exhaled an unpleasant odour, but failed to assume the appearance characteristic of *B. enteritidis*.

A sample of mud was also collected from the surface of the oyster-bed. It was black in colour, and smelt abominably. To 100 c.c. of sterile water 10 grams of this mud was added and thoroughly shaken up. Dilutions were then established, containing from 1·0 c.c. to 0·0001 c.c. of this suspension, and corresponding to from 0·1 to 0·00001 gr. of the mud. The result was that the two first tubes alone showed development, and yielded on plating-out, liquefying colonies and cocci in the case of the 1·0 c.c. tube, and in that of the 0·1 c.c. tube coccus colonies only (see Plate I., fig. 9, M1 and M2). This result shows either that there was no *Coli* in the quantity taken of the mud, or (which I am inclined to think is more probable) that *Coli* fails to maintain itself in the presence of certain intensely putrefactive organisms. The phenol-broth tubes exhaled an appalling stench.

Nor were the results of the *enteritidis* test very striking when applied to this mud. Only the lowest dilution responded with typical results, and it would therefore appear that this very foul material was not found to contain any germs of *Coli*, and to contain less than 100 germs of *enteritidis* per gramme. I think it highly desirable that similar specimens of foul-smelling mud should be repeatedly examined by more than one method for the detection of *B. coli*.

Sutton.

On May 4th 1903, accompanied by Dr. T. J. Browne (Medical Inspector, Local Government Board), I visited the layings at Sutton, on the Northern Shore of Dublin Bay, and abutting on the Promontory of Howth. The following samples were collected:—Six "American Blue-point" oysters, one "Portuguese" oyster, water, and sandy mud from the beds.

Not one of the seven oysters was found to contain *B. coli* (one harboured a pseudo-coli species), nor could it be detected in the water or mud, which was clean and sandy.

The same samples were also subjected to the *enteritidis* test, with the following result:—Oysters 2, 4, 5, and 6 ("American Blue-points"), as well as the Portuguese oyster, and the sand and water, gave the typical change in litmus-milk.

These results do not, in my opinion, justify any positive conclusion as to the presence or possibility of sewage-contamination of the layings at Sutton. It would be necessary, before making a definite statement on this point, to examine a larger number of samples, and to take them at a season when the neighbouring houses contained their summer population, which was not the case at the time of our visit.*

Merrion.

On May 9th, in company with Dr. Edgar Flinn, I visited the Southern Shore of Dublin Bay, and collected the following specimens:—

Group 1.—Six cockles, from a point about 60 yards from high water-mark, and about 50 yards to the west of Merrion Gates.

Group 2.—Six cockles from further out—some 400 yards below high water-mark.

* On Sept. 11th Dr. Browne and I revisited this locality and collected 6 oysters, three of which I found to contain *B. coli* in 1 c.c. The water and ground formation taken at the same time gave negative results. See Appendix page 142. [E. J. McW.]

Group 3.—Six cockles from the furthest point that could be reached dry-shod about mid-way between Merrion and Booterstown Stations. The distance from the mainland I estimated at about 900 yards.

Water was also collected from the returning tide at this extreme point, and a sample of mud was collected from a clean-looking spot, opposite Merrion Gates, and about 350 yards from the railway embankment.

Details as to quantities of material used will be found in the tabulated statement, and the outcome of the examination may be summarised as follows:—

Taking the *Coli* results first—3 of the 6 cockles in Group 1, 5 of those in Group 2, and four of those in Group 3 yielded a positive result, whereas both water and mud were totally negative, although unusually large quantities were operated on. As regards *enteritidis*, all the 18 cockles, with the exception of one from Group 3, evoked the typical change in milk. The mud gave the test but not the water.

The shell-fish (cockles) from Sandymount Strand would, therefore, appear to have been extensively contaminated with sewage on the occasion of my visit.

My next examination of material from the shores of Dublin Bay took place ten days later, on the 19th May, when Dr. Edgar Flinn handed me samples of cockles collected by him at Clontarf a couple of hours previously. Clontarf
Cockles.

The first group of these was taken on the strand opposite Victoria-terrace. It consisted of six cockles, each of which I tested for *Coli* and *enteritidis*, with the result that *Coli* was found in all, and *enteritidis* in all but one (No. 4), which changed the milk atypically.

The second group consisted of six cockles, collected by Dr. Flinn on the strand opposite "Watson's House," at Clontarf. Certain of these cockles contained putrefactive organisms of abnormally vigorous growth at blood-heat, and caused the phenol-broth tubes inoculated from them to become unusually turbid, in one case, blackish in hue—I refer, of course, to the culture fluid—and to admit a nauseating odour of putrefaction. The plates made from these two tubes exhibited only liquefying organisms, whilst those made from the four other broth-tubes, in which the putrid form of decomposition was not so well marked, yielded typical coli-form colonies. All six were found to contain *B. enteritidis sporogenes*.

On May 25th, Dr. Flinn collected and brought to me six cockles from the strand at Irishtown, taken at a point midway between the mainland and the New Isolation Hospital at the "Pigeon House." Two of the six proved to contain *B. coli*, three gave rise to coccus colonies only, whilst the sixth produced a turbidity in the phenolated-broth which was found on microscopic examination to be caused by the presence of innumerable ciliated cells, evidently derived from the branchial epithelium of the mollusc. All six yielded *B. enteritidis*. Irishtown.

On the 11th June, 1903, Dr. Flinn brought to the Laboratory nine mussels from the strand at Blackrock (south shore of Dublin Bay), to the east of Sandymount. Eight of the nine yielded typical *Coli*, the colonies on the plates partaking of both the filmy and the *aerogenes* or discoid character. The exception (No. 8) yielded a plate which was precisely similar to the others, and which might have been passed without hesitation as covered with *Coli* colonies. In accordance with the invariable rule which I have followed throughout the investigation, of subjecting at least one coli-form colony on each plate to sub-culture and subsequent testing, I re-inoculated two colonies, one filmy the other discoid, and found that both germs agreed in being weak fermenters of lactose, weak curdlers of milk, and weak producers of indol. The question presents itself whether the vital arrangements of the mussel could have altered a previously normal strain of *Coli* in this direction, or whether the sewage matter ingested by the mussel, originally contained a typhi-form variety of *Coli*. Every one of these nine mussels was found to contain *B. enteritidis*. Plate II., fig. 5, shows the typically changed milk tubes, whilst the *Coli* results are reproduced on the same Plate, figs. 2, 3, and 4. Blackrock.

Clontarf. North
Bull.

On July 8th I received from Dr. Edgar Flinn six cockles collected by him at "The North Bull," and also six mussels from a spot about thirty yards to the north of that place. Every one of the cockles, and all the mussels save one, yielded typical *Coli*. [See Plate II., figs. 8 and 9.] Both cockles and mussels proved, without a single exception, to contain *enteritidis*. [See Plate II., figs. 6 and 7.] It should be mentioned that the plate made from the solitary mussel that did not yield *Coli* was so thickly covered with rapidly liquefying colonies, that *Coli* might very readily have escaped observation. Shell-fish from this locality would, therefore, seem to present a maximal degree of sewage-contamination.

This completes the work hitherto accomplished on the oyster-layings and cockle strands round the shores of Dublin Bay. The result of the Bacterioscopic test confirms in a very conclusive manner the opinion I formed based upon ordinary inspection of the localities, viz., that they are exposed in a remarkable degree to pollution with sewage, and that the shell-fish occurring naturally, or purposely laid down along these shores, are permanently, and of necessity, contaminated to a grave extent, with the organisms characteristic of sewage, and are therefore liable to serve as vehicles for the conveyance of these germs, and with them of the germ of Enteric Fever into the system of persons who use these shell-fish as articles of food.

LAYINGS AT BALDOYLE AND MALAHIDE, COUNTY DUBLIN.

These localities, being on the North of the Isthmus which connects the Promontory of Howth with the mainland, are shut off from Dublin Bay. It is therefore necessary to deal with them in a separate division of the report. Being situated in the immediate vicinity of Dublin Bay, they may properly be dealt with immediately after it.

Before detailing the result of the examinations, I wish to state expressly that I do not consider that the number of the specimens tested or the period at which they were collected (before the arrival of the temporary summer population), can be held to justify any favourable generalisation from the almost entirely negative character of the results.

On the 4th May, after visiting and collecting specimens at Sutton, Dr. Browne and I proceeded to Baldoyle, where we collected, not without difficulty, six cockles, together with samples of mud and water. Both the latter looked clean. Tested for *Coli*, all the cockles yielded negative results, with one exception (No. 3), the stock sub-culture of which was unfortunately mislaid through obliteration of the label, and could not be identified. The only record I have is in the Laboratory note-book, and reads as follows:—

"Baldoyle Cockle 3, plate too crowded; a second plate made showed filmy coli-form colonies consisting of *Bacilli*, not unlike typhoid and actively motile; diplococcal forms intermixed." According to my experience, this would probably have proved to be true *Coli*. All six cockles evoked the typical *enteritidis* change in milk. Both mud and water were negative for *Coli*. Tested for *enteritidis*, the mud was positive, whilst the water again yielded a negative result.

The material obtained from Malahide consisted of eight oysters from Mr. Petrie's bed, taken at low water by Dr. Browne on May 4th. Six of them were tested as usual. Not one of the six yielded a coli-form colony. Two of them gave development in the phenol-broth, but plating out yielded only cocci. Together with the oysters, Dr. Browne brought in two samples of water, one taken on the layings at dead low tide, the other two hours after the beginning of the flood. Both yielded negative results to the tests for *Coli* and *enteritidis*. A sample of the sandy mud from the layings was negative for *Coli*. It contained the same coccus as two of the oysters. For *enteritidis* it gave a positive result.

+ signifies that the organism tested for was found.

— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
I. Clontarf American Blue-Point. [22-1-03].				
Oyster No. 1, . . .	+	Germ-content 10,000 per c.c. ; cocci on plates.		Not tested.
„ No. 2, . . .	+	Approximately same germ-content.		„
II. Clontarf “ East-River ” Oysters [laid down 2 months].				
Oyster No. 1, . . .	!+	Coli-form on plate; not further tested; germ-content 2,000 per c.c.	}	Not tested.
„ No. 2, . . .	+	<i>Aerogenes</i> type of <i>Coli</i> on plate; germ-content 1,000 per c.c., mostly liquefying.		
„ No. 3, . . .	+	Filmy <i>Coli</i> : also <i>aerogenes</i> -like colonies which ultimately liquefied gelatine.		
„ No. 4, . . .	+	<i>Coli</i> of either variety obtained from each.		
„ No. 5, . . .	+			
„ No. 6, . . .	+			
III. Clontarf “ East-River ” Oysters [laid down 10 months].				
Oyster No. 1, . . .	+	Done by plate-method only; <i>Coli</i> obtained. Germ-content of No. 1, 1,000, of No. 2, 1,500 per c.c.	}	Not tested.
„ No. 2, . . .	+			
„ No. 3, . . .	+	<i>Coli</i> of either variety obtained from each.		
„ No. 4, . . .	+			
„ No. 5, . . .	+			
„ No. 6, . . .	+			
IV. Clontarf Oysters picked out of heap of dead shells				
Oyster No. 1, . . .	+	Germ-content about 3,000 per c.c. <i>Coli</i> on plates.	}	Not tested.
„ No. 2, . . .	+			
„ No. 3, . . .	+	<i>Coli</i> obtained from all.		
„ No. 4, . . .	+			
„ No. 5, . . .	+			
V. Oysters from most inland part of layings, Clontarf.				
Oyster No. 1, . . .	+	Germ-content 2,000 per c.c.		Not tested.
„ No. 2, . . .	+			„
„ No. 3, . . .	+			„
„ No. 4, . . .	+			„
VI. Oysters from a point still nearer the shore.				
Oyster No. 1, . . .	+	Very large, old oyster : germ-content 1,000. <i>B. figurans</i> and coliform on plate,		Not tested.
„ No. 2, . . .	+			„
„ No. 3, . . .	+			„

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
VII. Cockles from surface of Foreshore, Clontarf.				
Cockle No. 1, . . .	+	Germ-content 1,000 per c.c., several coliform on plate.		} Not tested.
" No. 2, . . .	—			
" No. 3, . . .	+			
" No. 4, . . .	—			
" No. 5, . . .	—			
VIII. "North-Sea" Oysters from Clontarf. [10-4-03.]				
Oyster No. 1, . . .	+	<i>Coli</i> -content between 100 and 1,000 per c.c. Mostly <i>aerogenes</i> . Filmy <i>Coli</i> .	+	<i>Enteritidis</i> in 1 c.c.
" No. 2, . . .	+		—	Change not typical.
" No. 3, . . .	+		—	Milk unchanged.
IX. "Cork" Oysters from Clontarf.				
Oyster No. 1, . . .	+	<i>Coli</i> -content between 10 and 100 per c.c.	+	<i>Enteritidis</i> in 1 c.c.
" No. 2, . . .	+		+	Change typical, but culture a mixed one.
" No. 3, . . .	+		—	Litmus reduced in lower half of tube.
X. "Carlingford" Oysters from Clontarf.				
Oyster No. 1, . . .	+	Germ-content between 100 and 1,000 per c.c.	+	} Typical change in all.
" No. 2, . . .	+		+	
" No. 3, . . .	+		+	
XI. Clontarf Sea-water No. 1, . . .	—	<i>Coli</i> not detected in 1 c.c., <i>Coli</i> -content between 10 and 100 per c.c. <i>Coli</i> probably overwhelmed by putrefactive organisms.	—	} <i>Enteritidis</i> not found in 1 c.c.
" " No. 2, . . .	+		—	
" Mud, . . .	—		+	Less than 100 spores of <i>Enteritidis</i> per gram.
XII. "American Blue Points" from Sutton, Co. Dublin.* [4-5-03].				
Oyster No. 1, . . .	—	Pseudo <i>Coli</i> found,	—	
" No. 2, . . .	—		—	
" No. 3, . . .	—		—	
" No. 4, . . .	—		+	
" No. 5, . . .	—		+	
" No. 6, . . .	—		+	
"Portuguese" Oyster from same place.	—		+	
Water from same place, . . .	—	Not in 1 c.c., . . .	+	In 1 c.c. water.
Mud " " " . . .	—	Not in a knife-pointful, . . .	+	In a knife-pointful.
XIII. Merrion Cockles, Group 1. [9-5-03.]				
Cockle No. 1, . . .	+	Average amount for each tube, 0.25 c.c. cockle water, and one-half of the mollusc.	+	} Same average amount used as for <i>Coli</i> . Result typical in all.
" No. 2, . . .	+		+	
" No. 3, . . .	+		+	
" No. 4, . . .	—		+	
" No. 5, . . .	—		+	
" No. 6, . . .	—		+	

* See foot-note on page 132.

+ signifies that the organism tested for was found,
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
XIV. Merrion Cockles, Group 2.				
Cockle No. 1, . . .	—	Plate liquefied, . . .	+	Same average amount used as for group 1.
„ No. 2, . . .	+		+	
„ No. 3, . . .	+	Average amount used same	+	
„ No. 4, . . .	+	as group 1.	+	
„ No. 5, . . .	+		+	
„ No. 6 . . .	+	No juice, body only used, .	+	
XV. Merrion Cockles, Group 3.				
Cockle No. 1, . . .	—	One half body used. No juice.	—	Coagulated, but no gas.
„ No. 2, . . .	+	One half body and 0.5 c.c. juice used.	+	Same amount used as for <i>Coli</i>
„ No. 3, . . .	—	Average amount used same as for group 1.	+	Amount same as for <i>Coli</i> .
„ No. 4, . . .	+		+	
„ No. 5, . . .	+		+	
„ No. 6, . . .	+		+	
Water from Merrion, . . .	—	<i>Coli</i> not found in 50 c.c.	—	Not in one c.c.
Mud „ . . .	—	Whole sample tested.	+	In a knife-pointful.
XVI. Cockles from opposite Victoria Terrace, Clontarf. [19-5-03.]				
Cockle No. 1, . . .	+		+	Change not typical.
„ No. 2, . . .	+		+	
„ No. 3, . . .	+		+	
„ No. 4, . . .	+		—	
„ No. 5, . . .	+		+	
„ No. 6, . . .	+		+	
XVII. Cockles from opposite "Watson's House," Clontarf.				
Cockle No. 1, . . .	+	These two failures to isolate <i>Coli</i> appear due to over-growth by putrefactive germs.	+	All yielded the typical change.
„ No. 2, . . .	—		+	
„ No. 3, . . .	—		+	
„ No. 4, . . .	+		+	
„ No. 5, . . .	+		+	
„ No. 6. . . .	+		+	
XVIII. Cockles from the strand at Irishtown, Co. Dublin. [25-5-03.]				
Cockle No. 1, . . .	+	Ciliated branchial epithelium rendered phenol-broth turbid.	+	Typical change in all.
„ No. 2, . . .	+		+	
„ No. 3, . . .	—		+	
„ No. 4, . . .	—		+	
„ No. 5, . . .	—		+	
„ No. 6, . . .	—		+	

+ signifies that the organism tested for was found.
 — signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.		
	Result.	Remarks.	Result.	Remarks.	
XIX. Mussels from Blackrock, Co. Dublin. [11-6-03.]					
Mussel No. 1	+	Pseudo <i>Coli</i> .	+	Typical change in all.	
" No. 2,	+		+		
" No. 3,	+		+		
" No. 4,	+		+		
" No. 5,	+		+		
" No. 6,	+		+		
" No. 7,	+		+		
" No. 8,	?—		+		
" No. 9,	+		+		
XX. Cockles from North Bull, Dublin. [8-7-03].					
Cockle No. 1,	+	Liquefiers may have obscured <i>Coli</i> .	+		
" No. 2,	+		+		
" No. 3,	+		+		
" No. 4,	+		+		
" No. 5,	+		+		
" No. 6,	+		+		
Mussels from near same place,					
Mussel No. 1,	+		+		
" No. 2,	+		+		
" No. 3,	?—		+		
" No. 4,	+		+		
" No. 5,	+		+		
" No. 6,	+	+			
XXI. Baldoyle Cockles. [4-5-03].					
Cockle No. 1,	—	Probably <i>Coli</i> ,	+		
" No. 2,	—		+		
" No. 3,	?+		+		
" No. 4,	—		+		
" No. 5,	—		+		
" No. 6, 1	—		+		
Water from same place,	—	Not in 1 c.c.,	—	Not in 1 c.c.	
Mud " " "	—	Not in a knife-pointful.	+	In a knife-pointful.	
XXII. Malahide Oysters. [4-5-03].					
Oyster No. 1,	—	Cocci, Cocci,	—	Gram-staining Bacilli, but milk alkaline separated into layers.	
" No. 2,	—		+	Litmus-milk bleached, not coagulated.	
" No. 3,	—		+		
" No. 4,	—		—		
" No. 5,	—	+	Solid clot, no gas.		
" No. 6,	—	—			
Water from same place at low tide.	—	Not in 1 c.c.,	—	Not in 1 c.c.	
Water from same place 2 hours after commencement of flood.	—	Not in 1 c.c.,	—		
Mud from same place,	—	Cocci, no <i>Coli</i> in a knife-pointful.	+	In a knife-pointful.	

COASTS OF COUNTIES OF WICKLOW AND WEXFORD.

The shell-fish from this locality consisted mainly of deep-sea oysters, obtained by dredging. They were amongst the largest I have seen, the diameter of the flat shell averaging five inches. They were curiously encrusted with marine organisms. Taken as they were from the bottom of the sea, several fathoms deep and some miles off a sparsely inhabited coast-line, these oysters could not be suspected of sewage contamination. For this reason the result of their examination furnishes valuable evidence of the reliability of the bacterioscopic test. Here, indeed, it may fairly be said that it is the test itself which is being tested, not the shell-fish. How fully the test justifies the expectations that have been based upon it may be seen by glancing down the result columns of the tabulated statements appended. In the *Coli* column only negative results are shown, with the solitary exception of a locality, the conditions prevailing at which I do not know, but which was described by Dr. Browne on the label of the packet as "close to the Dockyard, Wexford."

It will be further noticed that not only is *Coli* absent from all the deep-sea beds, but that *Enteritidis* is also either absent altogether, or, if present, represented in number so small as to be unable to produce the typical change in milk, either at all, or in the usual time. This can hardly be a mere coincidence, and the circumstance would appear to show that the concomitant absence of this organism may have at any rate a negative value in examinations of this kind.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
I. Oysters dredged off North Pier, Arklow 25-4-03.		Very large plump oysters.		
Oyster No. 1, . . .	—	Phenol-broth remained sterile,	—	All unchanged in 24 hours. In 48 hours No. 1 was slightly bleached (litmus-milk was used). In 96 hours No. 1 was bleached below, No. 2 showed atypical change (clot solid, no gas). No. 3 was slightly bleached below.
" 2, . . .	—		—	
" 3, . . .	—		—	
II. Oysters from Mizen Head, Brittas Bay (Co. Wicklow), dredged 25-4-03.		Large oysters, not so plump as No. 1 batch.		
Oyster No. 1, . . .	—	All remained sterile, .	—	Became bleached throughout, alkaline on surface.
" 2, . . .	—		—	No change.
" 3, . . .	—		—	
III. Oysters and mussels dredged off Norris Castle C.G.S. (Co. Wicklow).		Large plump deep-sea oysters.		
Oyster No. 1, . . .	—	All remained sterile, .	—	Lower half became bleached.
" 2, . . .	—		—	Litmus turned red above, semi-translucent serum below, disgusting smell.
" 3, . . .	—		—	Unchanged in 4 days.
Mussel No. 1, . . .	—	Yellow liquefying coccus obtained.	+	Atypical change, clot a little too solid. Micro., typical <i>enteritidis</i> mixed with sporing bacilli.
" 2, . . .	—	Remained sterile, .	—	Remained sterile.
" 3, . . .	—		—	

+ signifies that the organism tested for was found.
 — signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.	
	Result.	Remarks.	Result.	Remarks.
IV. Oysters from Public Oyster Bed off Dogger Bank at entrance to Wexford Harbour.		Enormous oysters.		
Oyster No. 1, . . .	—	All negative, . . .	—	—
„ 2, . . .	—		—	—
„ 3, . . .	—		+	Change doubtfully typical, but typical bacilli found microscopically.
V. Mussels from Slaney River close to Dockyard, Wexford, taken 29-4-03.				
Mussel No. 1, . . .	—		—	Change looked almost typical, and Gram-staining rods found, but they contained <i>spores</i> .
„ 2, . . .	+	Large irregularly fringed <i>Coli-form</i> colonies, consisting of small lazily motile bacilli, proved to be genuine <i>Coli</i> .	—	Remained unchanged.
„ 3, . . .	+		+	Typical change in 24 hours.
VI. Cockles from Strand outside Breakwater, Wexford, taken 27-4-03.				
Cockle No. 1, . . .	—	All three yielded streptococci, forming beautiful small pearly-white colonies, not liquefying the gelatine, and producing uniform turbidity in broth.	—	Change atypical.
„ 2, . . .	—		+	Change came on slowly.
„ 3, . . .	—		—	Litmus milk-displayed parti-coloured layers.

COAST OF COUNTY OF WATERFORD.

WATERFORD HARBOUR.

The material sent from this locality comprised a number of mussels, cockles, and periwinkles from the Estuary of the Rivers Suir and Blackwater to the East of Passage East and Woodstown. The samples were collected on the 24th July at low water of spring tide, and samples of the water and mud were taken and forwarded at the same time. The result of the examination was as follows:—All six mussels gave rise to development in the phenol-broth. Typical coli-form colonies did not, however, appear on any of the plates made from this series of tubes. On two of the plates there developed doubtful colonies which it was considered advisable to subculture, but their non-coliform character was soon borne out by their inability to develop in broth at 37 degrees. The other mussel-plates produced only cocci and *Proteus*. Five out of the six produced typical *Enteritidis* change in milk.

The cockles gave a less equivocal response to the *Coli* test. Two of the six yielded typical filmy coli-form colonies in a state of purity. Five of the six reacted positively to the *Enteritidis* test. The water yielded *Coli* from as little as 1 cc., as did the mud from a knife-pointful. The water, furthermore, evoked the *Enteritidis* change in milk from as little as 1 cc., and a knife-pointful of the mud behaved similarly. On the other hand, a sample of water taken the same day at Woodstown Cockle-strand yielded negative results (1 cc.) both for *Coli* and *Enteritidis*, whilst the mud from the same place proved to contain both *Coli* and *Enteritidis* in the standard quantity.

The interpretation of these results is far from easy. The very wide diffusion of *Enteritidis* spores throughout the material taken from these localities may conceivably signify previous sewage contamination partly got rid of by the natural process of self-purification, and now indicated only by the presence of these resistant structures. On the other hand, the occurrence of *Coli* in the cockles would seem to indicate more recent contamination, whilst its presence—together with *Enteritidis*—in as little as 1 cc. of one of the samples is hardly explicable save on the hypothesis of recent and relatively considerable contamination. This is undoubtedly one of the cases in which the bacteriological results would seem to require a more extended basis of observation before a final decision as to the real character of the locality can be arrived at.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Specimen.	Tested for <i>B. coli communis</i> by Phenol-broth method.		Tested for <i>B. enteritidis sporogenes</i> by Klein's method.		
	Result.	Remarks.	Result.	Remarks.	
I. Mussels from near Woodstown, Waterford Harbour.					
Mussel No. 1, . . .	—	Chiefly cocci, . . .	+	Atypical.	
„ No. 2, . . .	—	Cocci, . . .	+		
„ No. 3, . . .	—	Very doubtful aerogenes-like colony.	+		
„ No. 4, . . .	—	Cocci, . . .	+		
„ No. 5, . . .	—	A few very doubtful coli-form colonies, broth sub-culture failed to develop.	—		
„ No. 6, . . .	—	Nothing coli-form on plate, .	+		
II. Cockles from Woodstown Strand, Waterford Harbour.					
Cockle No. 1, . . .	—	Phenol-broth sterile, .	—	Atypical.	
„ No. 2, . . .	—	Proteus + cocci, .	+		
„ No. 3, . . .	—	Phenol-broth sterile, .	+		
„ No. 4, . . .	—	Cocci + 1 Proteus colony, .	+		
„ No. 5, . . .	+	Typical <i>coli</i> filmy var., .	+		
„ No. 6, . . .	+	„ „ .	+		
Sent with mussels {	Water from East of Woodstown and Passage East.	+	<i>Coli</i> in as little as 1 cc., .	+	Milk unchanged.
	Mud from same place	+	In a knife-pointful, .	+	
Sent with cockles {	Water from Woodstown cockle strand.	—	Absent from 1 cc., .	—	
	Mud from same place	+	Present in a knife-pointful, .	+	

E. J. McWEENEY.

August, 1903.

APPENDIX TO REPORT.

As already pointed out in the preliminary observations, the results of the bacterioscopic examination of specimens sent to the laboratory accords on the whole quite satisfactorily with the conclusions arrived at as the result of local inspection. In regard to certain localities there were, however, discrepancies of a more or less pronounced character. It seemed desirable, therefore, to repeat the examination and inspection in as many of these cases as time and opportunity would permit, with the object of ascertaining whether the conclusions apparently pointed to by the first analysis or inspection, might not require modification.

LAYINGS AT SUTTON, CO. DUBLIN.

Accordingly, on the 11th September, 1903, I visited, in conjunction with Dr. Browne, the layings at Sutton which had on the former occasion yielded a negative result as regards *Coli*. The samples now collected by ourselves near the furthest point of the layings consisted of six oysters, water, and mud. The result may be briefly stated. Three of the oysters yielded *B. coli* from 1 cc. of their contents, and the suspicion to which I ventured to give expression on p. 132, that the previous negative result may have been due to the absence of the summer population on that occasion, is thus in some measure strengthened. The mud and water, however, failed to yield *Coli* even from 20 grams of the former and 100 cc. of the latter.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Specimen.	Tested for <i>B. coli communis</i> by Phenol-broth method.	
	Result.	Remarks.
Oysters from Sutton collected [11-9-03].		
Oyster No. 1,	—	Phenol-broth sterile.
" No. 2,	+	<i>Coli</i> , filmy var. (formed a little indol).
" No. 3,	+	Both vars. of <i>coli</i> .
" No. 4,	—	Phenol-broth sterile.
" No. 5,	+	<i>Coli</i> , filmy var.
" No. 6,	—	<i>Pseudo-coli</i> (weak fermenter of lactose ; very weak producer of indol).
Water from same place,	—	Not in 100 cc.
Mud " "	—	Not in 20 grams.

(The previous results can be seen on p. 136, Table XII.).

LAYINGS IN CARLINGFORD LOUGH.

Another locality which it seemed desirable to re-examine was Carlingford Lough, including the Newry River which is heavily contaminated with sewage, as may be seen from Dr. Browne's Report, page 66. On referring to the tabulated statement, on pp. 124, *seq.*, it will be seen that not a single positive *Coli* result was obtained from several layings (Nos. I., II., III., and IV. on pp. 124, 125) which might have been reasonably suspected of sewage contamination, whilst in the case of layings No. V. only one positive result was indicated. The fresh samples were kindly collected by Dr. Finegan, of Carlingford, and sent up early in October. The result of the re-examination was that *Coli* was found in no less than four of the six oysters from laying No. III. as well as in one of two samples of the mud. It was also found in four of six oysters from laying No. V., and in the mud, whilst, from the water pseudo-forms were obtained approaching nearer to true *Coli* in the case of the selected colony obtained from 0.1 cc. than in that obtained from 1 cc. It may here be explained that the turbidity of this sample of water was so marked that I thought proper to test 0.1 as well as 1 cc., with the result just stated. For the reason given below neither was tested for *Enteritidis*.

Lastly, the oysters from the public beds between Narrow Water and Warrenpoint (laying No. IV., page 125) yielded precisely similar results—*four* out of *six* contained *Coli*.

It will thus be seen that the result of this re-examination contradicts that of the first one and corroborates the views expressed by Dr. Browne as the result of local inspection. Why *Coli* was absent on the former occasion is not clear. One highly significant circumstance may be briefly alluded to, though I cannot, at present, discuss it in all its bearings, viz., the presence of *Streptococci* and of *Enteritidis* in the oysters, mud, and water from these layings. In no batch of material submitted to me during the course of this extended investigation have *Streptococci* been so prominent a feature as in this one, and in very few batches has *Enteritidis* been more widely distributed. By referring to the remarks column of the table, on page 124, the following facts will be observed:—

LAYING No. I.—*Coli* absent; *Streptococci* present in 5; *Enteritidis* in 5 out of 8 samples.

LAYING No. II.—*Coli* absent; *Streptococci* in 4; *Enteritidis* in all of 8 samples.

LAYING No. III.—*Coli* absent; *Streptococci* in 3; *Enteritidis* in all of 8 samples.

LAYING No. IV.—*Coli* absent; *Streptococci* in 3; *Enteritidis* in 4 of 8 samples.

LAYING No. V.—*Coli* in one; *Streptococci* in 3; *Enteritidis* in 7 of 8 samples.

It would almost seem as though, in the absence through some unexplained cause of the organism which is admittedly the chief danger-signal, the occurrence of *Streptococci* and *Enteritidis* in any large proportion of the samples tested after the manner adopted in this investigation, should be taken as pointing to existence of sewage contamination. The views of Klein as regards the significance of *Enteritidis* and of Houston as regards that of *Streptococci* would thus obtain material confirmation. The re-examination shows the absence of *Coli* to be a temporary occurrence and co-incidentally with its appearance, the *Streptococcus* is no longer encountered. A probable explanation of its disappearance is that under the given conditions it cannot maintain the struggle against *Coli* which overgrows it and monopolises the phenol-broth. Under different conditions of experiment—*e.gr.* direct agar-plating of the original material as recommended by Houston, the *Streptococcus* might have been oftener detected and its precise significance more exactly determined.

+ signifies that the organism tested for was found.

— signifies that the organism was not found.

Source and Nature of Specimen.	Tested for <i>B. coli communis</i> by Phenol-broth method.	
	Result.	Remarks.
I. Oysters from Mussens Layings, Drummullagh, Carlingford Lough [6-10-03].		
Oyster No. 1,	+	Filmy var. of <i>Coli</i> .
" No. 2,	+	Both vars. of <i>Coli</i> .
" No. 3,	—	Plate liquefied.
" No. 4,	+	Both vars. of <i>Coli</i> .
" No. 5,	—	Suspected colony liquefied gelatine, and failed to ferment lactose.
" No. 6,	+	Both vars. of <i>Coli</i> .
Mud from same place, [No water sent].	+	<i>Coli</i> from a knife-pointful.
Mud from same place, [2nd sample].	—	<i>Coli</i> absent from a knife-pointful.

+ signifies that the organism tested for was found.
 — signifies that the organism was not found

Source and Nature of Specimen.	Tested for <i>B. coli communis</i> by Phenol-broth method.	
	Result.	Remarks.
II. Oysters from McDonald's Layings, Newry River (6-10-03).		
Oyster No. 1,	—	Phenol-broth sterile.
" No. 2,	+	Filmy <i>Coli</i> .
" No. 3,	+	" "
" No. 4,	+	Both vars. of <i>Coli</i> (one turned out to be a Pseudo-form).
" No. 5,	—	Pseudo-form liquefying gelatine.
" No. 6,	+	Good <i>Coli</i> , a little weak on neutral-red.
Mud from same place,	+	Good <i>Coli</i> , and pseudo-forms.
Water " " 1 cc.,	—	Pseudo-forms only.
" " " 0.1 cc.,	? +	Almost typical <i>Coli</i>
III. Oysters from Public Beds between Narrow Water and Warrenpoint (6-10-03).		
Oyster No. 1,	—	Plate liquefied.
" No. 2,	+	Filmy <i>Coli</i> .
" No. 3,	—	Phenol-broth sterile.
" No. 4,	+	Filmy <i>Coli</i> .
" No. 5,	+	" "
" No. 6,	+	<i>Coli</i> of both varieties.

[Owing to lack of substrata, and absence of Assistant through illness, the water and mud from this locality could not be dealt with. For the same reasons only the first twelve specimens in the above table could be tested for *Enteritidis*, viz. :—the six oysters from Mussen's (2 positive, 4 negative or atypical results), the two muds from Mussen's (both typical), and four oysters from McDonald's (2 positive and 2 negative results).]

LAYINGS IN KENMARE RIVER, COUNTY KERRY.

The third locality selected for re-examination was Kenmare "River," an arm of the sea in County Kerry. About 50 per cent. of the oysters had, on the former occasion been shown to contain *Coli*, and about the same number had yielded *Enteritidis*. (See tabulated statement on p. 105.) From this I drew the conclusion that the beds were contaminated. On local inspection they were, however, passed as practically free from risk of sewage pollution. It therefore seemed essential to ascertain which result—that of local inspection or that of bacteriological examination was the one to be relied on. Accordingly I arranged for a personal visit to the locality with Dr. Browne, who very kindly made all arrangements, and on September 23rd we carried out, under circumstances of great difficulty, a joint inspection of the bed described by Dr. Browne as Ardea Oyster Bed, on p. 24, and referred to by me as No. III. in the table on p. 105. The result was that we found a small stream of apparently clean water trickling through the boggy ground and entering the head of Kilmakilloge Harbour at a point about 300 yards from the layings. This stream constituted the overflow from the cesspool of a neighbouring mansion. I took a sample in a sterilised bottle, and, having returned to Dublin the same afternoon, subjected it to fractional examination next day with the result that it proved to contain at least 10,000 *Coli* per cubic centimetre. It was, moreover, fairly bright and unobjectionable in appearance. The oysters collected at the same time yielded *Coli* in the case of 5 out of 6, and so did 1 cc. of the water, and the usual quantity of mud. It will thus be seen that the final result came out in favour of the bacterioscopic test, the source of the *Coli* having been discovered on a second inspection. My conclusion is that when similar discrepancies occur they should be cleared up by the means that proved effective in this instance. A striking example of the extreme delicacy of a bacterioscopic test for sewage is also afforded by this occurrence. The streamlet was not more than a foot wide and a few inches deep. It trickled down, almost buried amongst the tall sedges and other littoral vegetation, and might readily have escaped observation, as in fact it did, on the first occasion.

The volume of water which it pours into Kilmakilloge Bay is quite insignificant, and, moreover, has to traverse a distance of 300 yards of inter-tidal shore before reaching the beds, as well as to round a small projecting angle of the coast-line. All this it would seem to accomplish, and to influence the bacterial flora of the oysters, water, and mud in a manner perceptible to the delicate methods which bacteriology has placed in our hands.

The re-examination of specimens from the other beds along the shore of the Kenmare River likewise yielded results confirmatory of those obtained on the first occasion, and in their case also local inspection, carried out by Dr. Browne, revealed the source of the contamination. (See pages 22 and 23.)

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.	
	Result.	Remarks.
I. Oysters from Derryquinna Layings, Kenmare River. (28-9-03).		
Oyster No. 1,	—	Plate liquefied.
" No. 2,	—	"
" No. 3,	—	Organism " subcultured proved not to be <i>Coli</i> .
" No. 4,	+	<i>Coli</i> , a little weak in neutral-red-agar.
" No. 5,	—	Plate liquefied.
" No. 6,	—	Primary broth-culture died out: the liquid contained indol.
" No. 7,	+	<i>Coli</i> , a little weak in indol formation.
" No. 8,	+	<i>Coli</i> , a little weak in neutral-red.
" No. 9,	+	" "
" No. 10,	+	" "
" No. 11,	—	Plate liquefied, bore traces of coli-form colonies.
" No. 12,	—	" "
Water from same place (1 cc.),	—	Liquefying streptococci.
Mud " "	+	<i>Coli</i> , a little weak in indol formation.
II. Oysters from Templehoe Layings, Kenmare River. (28-9-03).		
Oyster No. 1,	+	Typical <i>Coli</i> .
" No. 2,	+	<i>Coli</i> , a little weak on neutral-red and growing like typhoid on potato.
" No. 3,	+	Typical <i>Coli</i> .
" No. 4,	+	" "
" No. 5,	+	" "
" No. 6,	+	<i>Coli</i> , a little weak on neutral-red.
" No. 7,	+	<i>Coli</i> , growing like typhoid on potato.
" No. 8,	+	Typical <i>Coli</i> .
Water from same place (1 cc.),	?	Some doubt as to identity of tube.
Mud " "	+	Typical <i>Coli</i> from a knife-pointful.
III. Oysters from Derreen (Ardea) Layings, Kenmare River. (25-9-03).		
Oyster No. 1,	+	Typical <i>Coli</i> .
" No. 2,	+	<i>Coli</i> , a little weak on neutral-red.
" No. 3,	+	Typical <i>Coli</i> .
" No. 4,	+	" "
" No. 5,	—	Coli-form colony, failed to ferment lactose or change neutral-red.
" No. 6,	—	No growth in phenol-broth.
Water from same place (1 cc.),	+	Typical <i>Coli</i> .
" " Derreen Cesspool, (1 cc.),	+	" "
" " " " (0.1 cc.),	+	" "
" " " " (0.01 cc.),	+	" "
" " " " (0.001 cc.),	+	" "
" " " " (0.0001 cc.),	+	" "

NOTE.—The material from this last bed was tested for *Enteritidis* also, with the result that the first five oysters, and the two tests applied to the overflow from the cess-pool, yielded positive results, whilst the sixth oyster and the sea-water were negative.

BARROW HARBOUR, COUNTY KERRY.

Samples from this locality were re-examined on the 25th September, with the following results.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.	
	Result.	Remarks.
Oysters from M'Cowan's Bed, Barrow Harbour, quarter of an hour before low water.		
Oyster No. 1,	—	Plate liquefied.
" No. 2,	+	<i>Coli</i> producing rather less gas than usual in lactose-agar-shake.
" No. 3,	+	<i>Coli</i> producing transparent growth on potato.
" No. 4,	+	<i>Coli</i> like that from No. 2, streptococci also.
" No. 5,	+	Typical <i>Coli</i> .
" No. 6,	—	Pseudo- <i>coli</i> weak on neutral-red and producing no indol.
" No. 7,	—	Plate liquefied.
" No. 8,	—	"
" No. 9,	—	Small coli-form colonies on plate, confluent and unsuitable for sub-culture.
" No. 10,	—	No coli-form colonies on plate.
" No. 11,	—	Plate nearly liquefied ? any coli-form colonies.
Water from same place,		Not examined ; bottle broken in transit.
Mud " "	—	No development in phenol-broth.

BALLYSDARE BAY, COUNTY SLIGO.

It was thought advisable to re-examine specimens from this locality also, and the results may be gathered from the tabulated statement subjoined. The original results are to be found on p. 117 *seq.* The specimens from Cooper's layings were not examined till after the lapse of no less than twelve days after collection. During eleven days of that time the parcel containing them had stood in the refrigerator at a temperature of approximately 3 deg. C. The fact that *Coli* was isolated from two of the oysters, as well as from the water and mud, is of much interest as a contribution to our knowledge of the duration of life of this organism under certain conditions. All the oysters were alive on October 5th, the day of examination.

+ signifies that the organism tested for was found.
— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.	
	Result.	Remarks.
I. Oysters from Laying I. (owne's) (p. 117). (24-9-03.)		
Oyster No. 1,	—	Plate liquefied.
" No. 2,	—	" "
" No. 3,	—	Doubtful coli-form colonies on plate, unsuitable for sub-culture owing to liquefaction.
" No. 4,	—	" "
" No. 5,	+	<i>Coli</i> a little weak on neutral-red.
" No. 6,	—	Pseudo- <i>coli</i> , typical on plate, but did not change neutral-red and produced no indol.
Water from same place, (1 cc.)	—	Phenol-broth remained sterile.
Mud " " "	—	Phenol-broth sterile—a knife-pointful used.

+ signifies that the organism tested for was found.

— signifies that the organism was not found.

Source and Nature of Material.	Tested for <i>B. coli communis</i> by Phenol-broth method.	
	Result.	Remarks.
II. Oysters from Laying VI. (Crichton's), (p. 118.) (24-9-03.)		
Oyster No. 1,	—	Doubtful coli-form on plate.
„ No. 2,	—	Liquefying colonies only on plate.
„ No. 3,	+	Typical <i>Coli</i> .
„ No. 4,	+	„ „
„ No. 5,	—	Doubtful coli-form.
„ No. 6,	+	Typical <i>Coli</i> .
Water from same place (1 cc.)	—	Phenol-broth remained sterile.
Mud „ „ „	+	<i>Coli</i> weak on neutral-red.

NOTE:—The material from this bed was also tested for *Enteritidis* with a positive result in the case of oysters 3, 6, and the mud. Oysters 1, 2, 4 and 5, gave non-typical alterations in the milk, and the water (1 cc.) failed to change it at all.

III. Cockles from Laying VII. (Verschoyle's). (p. 119.) (25-10-03).		Large cockles furnishing 2 cc. juice, save Nos. 2 and 4.
Cockle No. 1,	—	Phenol-broth sterile.
„ No. 2,	—	Phenol-broth sterile, ($\frac{1}{2}$ cockle used).
„ No. 3,	+	Typical <i>Coli</i> + (liquefying colonies).
„ No. 4,	—	Streptococci on plate.
„ No. 5,	—	Streptococci (non-liquefying) on plate.
„ No. 6,	—	Phenol-broth sterile.
Water from same place,	—	„ „
Mud „ „ „	—	„ „

NOTE:—The *Enteritidis* test was also applied to the material from this bed with the result that three cockles Nos. 1, 4, and 5, and the mud reacted positively; cockles 2, 3, and 6 gave atypical changes, and the water (1 cc.) failed to produce any change in the milk.

IV. Oysters from Laying II. (Cooper's.) (p. 117). (24-9-03).		
Oyster No. 1,	—	Coli-form colonies which gave scanty growth in broth at 37°, therefore not <i>Coli</i> .
„ No. 2,	+	Typical <i>Coli</i> , save that it gave colourless growth on potato.
„ No. 3,	—	Phenol-broth sterile.
„ No. 4,	—	Doubtful Coli-form colonies.
„ No. 5,	—	<i>Subtilis</i> -like liquefying colonies only.
„ No. 6,	+	Typical <i>Coli</i> .
Water from same place,	+	100 cc. tested: typical <i>Coli</i> obtained. (Not in 1 cc.)
Mud „ „ „	+	Typical <i>Coli</i> , obtained from a knife-pointful.

NOTE:—These samples were also tested for *Enteritidis* with positive results in the case of Oysters 1, 2, and 6, as well as in that of the mud, whilst the remaining oysters and the water (1 cc.) gave negative results.

TABULATED SUMMARY OF RESULTS OF RE-EXAMINATIONS.

NAME OF LOCALITY.	Result of First Examination.		Result of Re-examination.		FINAL CONCLUSION.
	<i>Coli.</i>	<i>Enteritidis.</i>	<i>Coli.</i>	<i>Enteritidis.</i>	
Sutton, County Dublin, .	In none of 9 samples,	In 6 of 9 samples, .	In 3 of 8 samples, .	Not done, .	Absence of <i>Coli</i> on first occasion ascribed to absence of summer visitors.
Carlingford Lough, Layings Nos. III., IV., and V.	In 1 of 24 samples, .	In 20 of 24 samples,	In 14 of 23 samples,	In 6 of 12 samples, .	Absence of <i>Coli</i> on first occasion remains unaccounted for. Results of local inspection confirmed by re-examination.
Kennare River, County Kerry, .	In 9 of 24 samples, .	In 11 of 24 samples,	In 20 of 31 samples,	In 5 of 7 samples, .	Result of first examination fully confirmed
Barrow Harbour, County Kerry. .	In 2 of 8 samples, .	In 2 of 8 samples, .	In 4 of 13 samples, .	Not done, .	Previous result confirmed.
Ballysodare Bay, County Sligo, Layings Nos. I., II., VI., and VII.,	In 11 of 38 samples,	In 12 of 38 samples,	In 10 of 30 samples,	In 11 of 30 samples,	Previous result confirmed.

DUBLIN, 16th November, 1903.

E. J. McWEENEY.

PLATES.

EXPLANATION OF THE PLATES.

As already stated in my earliest Report to the Board on this subject (see p. 77) the camera has been systematically used throughout the research for the purpose of obtaining a permanent record of the appearances presented by the cultures. In selecting for reproduction the following out of the large number of available negatives, an attempt has been made to give a fair idea of the average results obtained. The selection has been confined neither to exceptionally good negatives, nor to typical cultures, nor yet to those exhibiting positive results. Wherever a comparison between two or more methods has been instituted, the outcome of such comparative study has been fully and fairly reproduced.

PLATE I.

Figs. 1-5 show the appearance of gelatine plate-cultures made directly from oyster-juice, and exemplify the wide differences in germ-content and germ-character between different oysters taken from the same place at the same time. Figs. 1, 2, and 3 are from three oysters from Rathcoursey, Co. Cork. The quantity of juice used was the same (0.1 cc.), and the cultures are two days old, having been kept at 21° C. The wide differences between each will be at once noted. In Fig. 2 many of the minute points are crystals, not colonies.

Figs. 4 and 5 represent similar plate-cultures from two Clontarf oysters. Fig. 4 presents an appearance very suggestive of sewage contamination, small, non-liquefying *Coli*-form colonies, intermixed with larger, grey, liquefying *Proteus* colonies. (0.1 cc. juice, two days at 21°.)

Fig. 5 shows a similar plate four days old. The increase in size and confluence of the *Proteus* colonies has liquefied the gelatine and rendered the isolation of *Coli* impossible. This early destruction of the more slow-growing *Coli*-form colonies is the chief reason for interposing a preliminary enrichment-culture in broth, &c., before plating-out. A small *Coli*-form colony of *aerogenes* type can be seen still intact near the middle of the plate. Fig. 4 is from an "American Blue Point" oyster taken from the Clontarf Layings, 22nd January, 1903. Fig. 5 is from an "East River" taken at the same time (see text, p. 128.)

Figs. 6-9 show the effect of the preliminary phenol-broth-culture in eliminating non-*Coli*-form species, and enabling *Coli* to develop undisturbed on the plates which have been inoculated by the surface-brushing method after suitable dilution.

Fig. 6 shows quantitative tests applied to a "North Sea" oyster from Clontarf (see text, p. 130.) A. is from the phenol-broth tube that received 1 cc. of the oyster-juice, and exhibits a mixture of *Coli*-form colonies of "filmy" and *aerogenes* pattern. B. is from 0.1 cc. juice from the same oyster similarly treated. It shows the filmy variety only. C. is from .01 cc. juice from same oyster, and shows the *aerogenes* type of *Coli* in the pure state. The black streak across one of the colonies is the track of the subculture-needle. F. is from 1 cc. of a so-called "Cork" oyster from Clontarf. It shows filmy *Coli* and a few very minute coccus colonies. A large liquefying colony, probably a contamination from the condensation-water has originated in this division, and has run across the plate threatening to destroy it.

Figs. 7 and 8.—Similar results from other Clontarf oysters (see text, pp. 130 and 131.)

Fig. 9, A1 and A2.—Dilute, surface-plate-cultures made from two "North Sea" oysters from Clontarf (see text, p. 131).

M1. (lettering obliterated) and M2.—Clontarf mud tested for *Coli*: negative results (see text, p. 132).

PLATE I.



Fig. 1

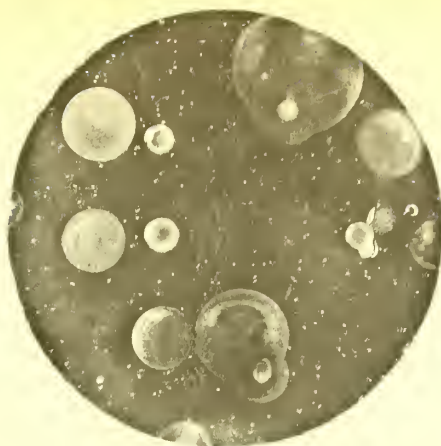


Fig. 2



Fig. 3

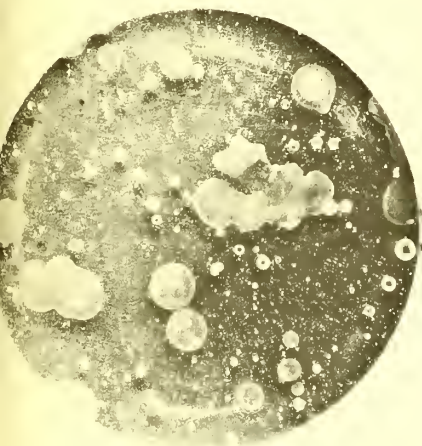


Fig. 4

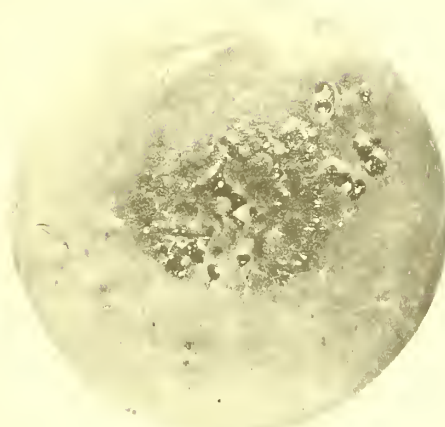


Fig. 5

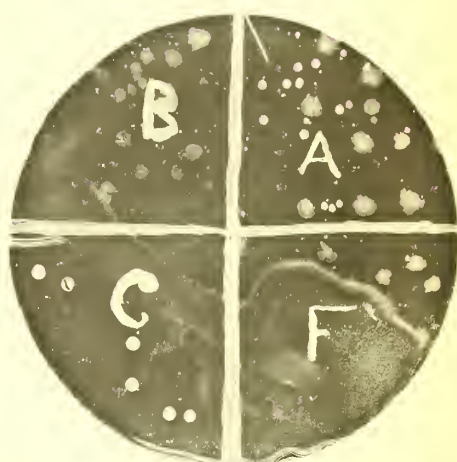


Fig. 6



Fig. 7

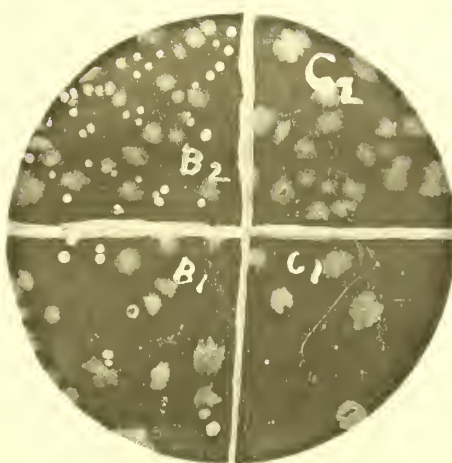


Fig. 8

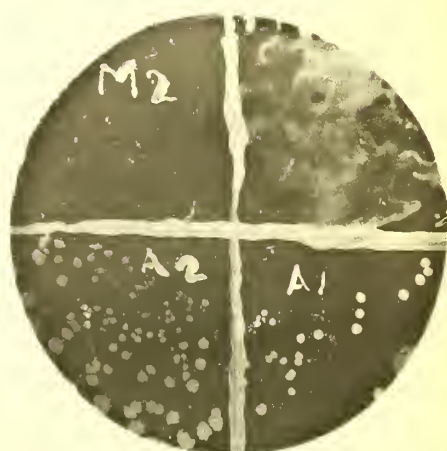


Fig. 9

PLATE II.

Fig. 1.—Clontarf water samples 1 and 2, quantitatively tested for *Coli*. Negative results from sample 1 (Divs. W. 1a. and W. 1c.). Typical filmy *Coli* from sample 2, corresponding to the two lower divisions on the plate (see text, p. 131).

Figs. 2, 3, 4.—Blackrock mussels (nine) tested for *Coli*, with positive results in the case of all but one. The exception is No. 8 (the middle division on Fig. 4) where the *Coli*-form colonies through quite indistinguishable from those on the other divisions proved to diverge from true *Coli* in the direction of typhoid (see text, p. 133).

Fig. 5.—The same nine Blackrock mussels tested for *Enteritidis*. Positive result in all.

Fig. 6.—Six Dollymount mussels tested for *Enteritidis*. Positive results in all. The details of the characteristically altered milk-cultures are well seen (text, p. 134).

Fig. 7.—The same test applied to six Dollymount cockles with like results (p. 134).

Fig. 8.—Each of the four divisions represents the result of the *Coli* test applied to one of the Dollymount mussels referred to under Fig. 6. The plate is partly destroyed by liquefaction and blurred by defective illumination, but typical *Coli*-form colonies occur on all the divisions.

Fig. 9.—The two remaining Dollymount mussels (Divs. 5 and 6), and the first two Dollymount cockles (Divs. 7 and 8) referred to under Figs. 6 and 7, tested for *Coli*, with positive results.

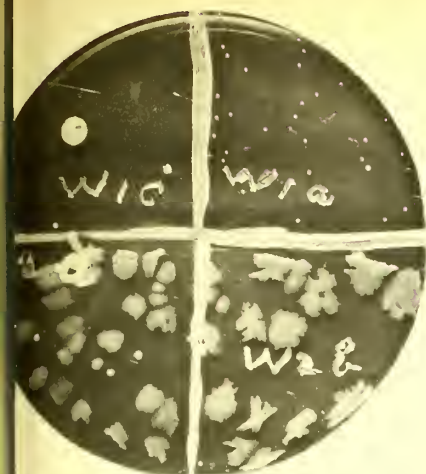


Fig. 1

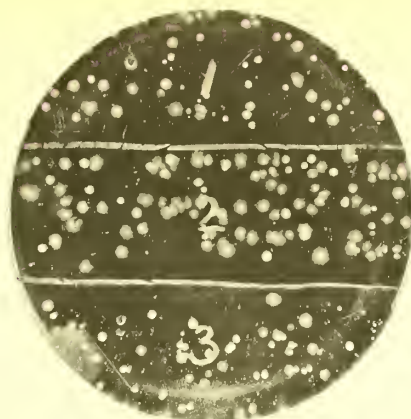


Fig. 2

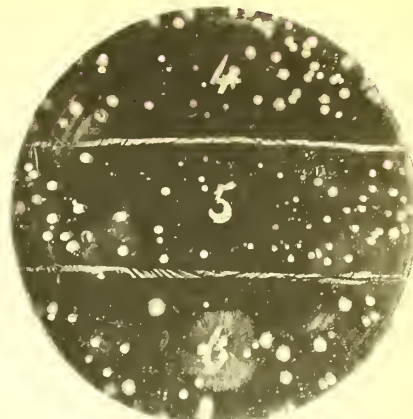


Fig. 3

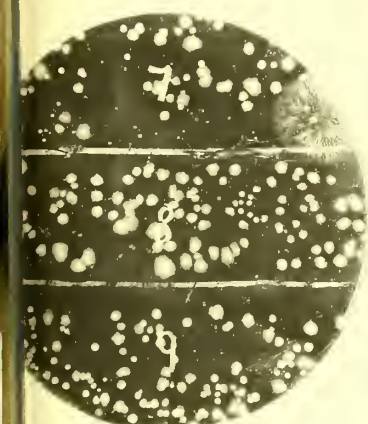


Fig. 4

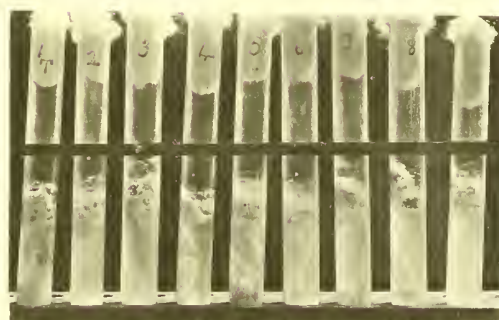


Fig. 5

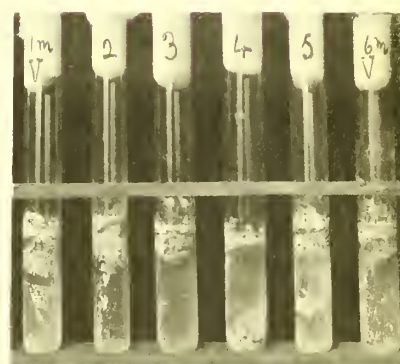


Fig. 6

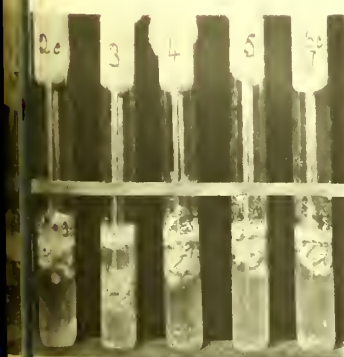


Fig. 7

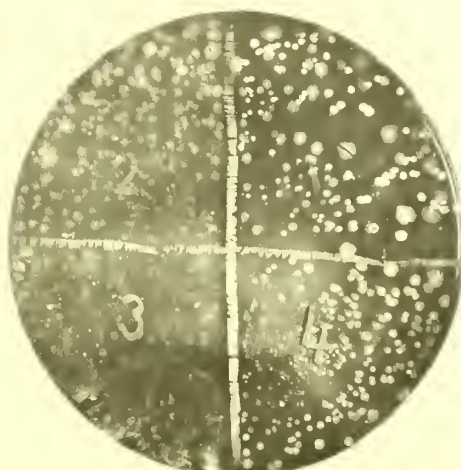


Fig. 8

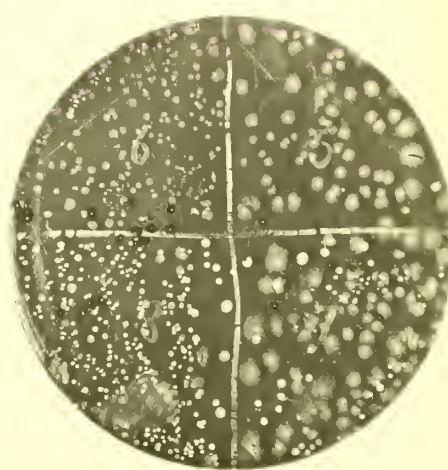


Fig. 9







PLATE IV.

- Fig. 1.—(Text, p. 103).—*Coli* test as applied to four mussels from Glandore Harbour, Co. Cork. Positive in the case of Div. 28 (=mussel, No. 5), only.
- Fig. 2.—*Coli* test applied to mussel No. 6 from Glandore (=Div. 29), result positive; to the mud from the same place (=Div. 31), result negative, only coccus colonies together with one *Proteus* colony appearing on the plate. Divs. 32 and 33 are from mussels Nos. 1 and 2 from Woodstown, Co. Waterford (see text, p. 140).
- Fig. 3.—Mussels from Woodstown, Co. Waterford. Nos. 3, 4, 5, and 6 (see text, p. 141).
- Fig. 4.—Divs. 39 and 41 are from Woodstown cockles. *Proteus* and *cocci* colonies are seen in both. Div. 44 is the result of the test as applied to the water from the same place, and shows typical *Coli* colonies, together with some others.
- Fig. 5.—Divs. 42 and 43 exhibit the result of the *Coli* test as applied to two cockles from Woodstown (text, p. 141), positive in each. Div. 45 shows the positive result of the test as applied to the mud from the same place. Div. 46, an oyster from Derreen Beds, Kenmare River, Co. Kerry (text, p. 105) tested with negative results.
- Fig. 6.—Div. 53, mud from Derreen Beds, Kenmare River, tested for *Coli*, *Proteus* colonies only, Div. 55, mud from Woodstown Cockle Strand, result very similar.
- Fig. 7.—*Coli* test applied to four oysters from Derreen Beds, Kenmare River (text, p. 105). Divs. 47, 48, and 50 corresponding to oysters Nos. 2, 3, and 5 bear typical *Coli* colonies. *Cocci* are a prominent feature of Div. 47. Div. 49 (=oyster No. 4) bears a few small non-*Coli*-form colonies.
- Fig. 8.—*Coli* test as applied to four oysters from Templenoe Beds, Kenmare River. Divs. 1, 3, and 6 corresponding to the oysters bearing the same numbers in the Table on p. 105, display typical *Coli* colonies. Div. 2 (=oyster No. 2) is negative.
- Fig. 9.—Divs. 9 and 13 represent results of the *Coli* test as applied to two oysters from Roaring-water Bay, Co. Cork (p. 104). Div. 9 corresponds to Oyster No. 1, and shows typical *Coli*. Div. 13 (=oyster No. 5) shows liquefying and *Coccus* colonies only. Div. 15 (=mud from same place) shows same result. Div. 17 is from an oyster from Derryquinna, Kenmare River (p. 105), and shows typical *Coli*.

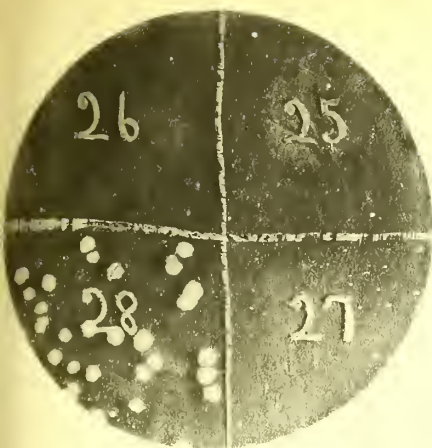


Fig. 1

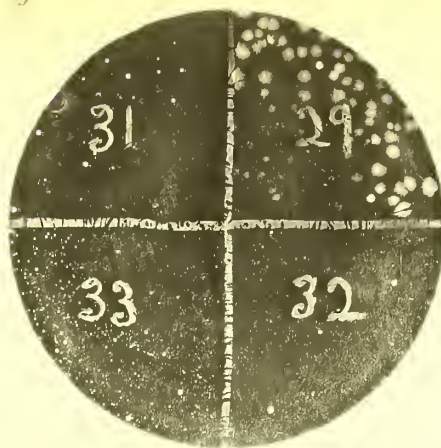


Fig. 2

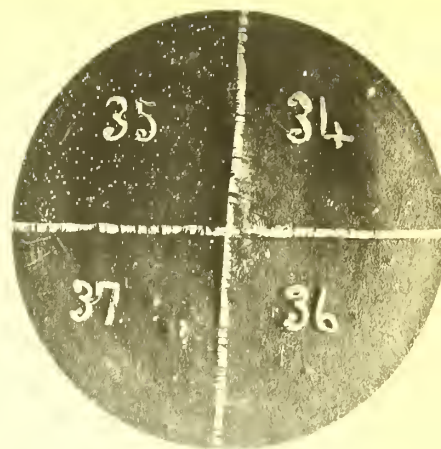


Fig. 3

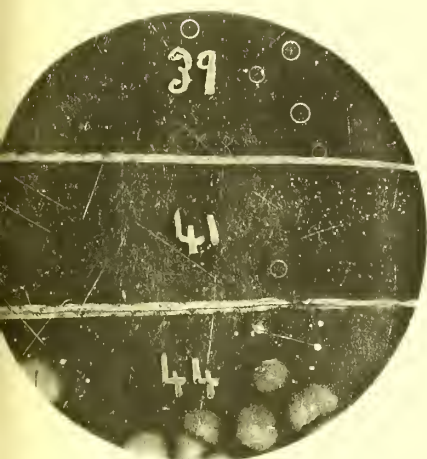


Fig. 4

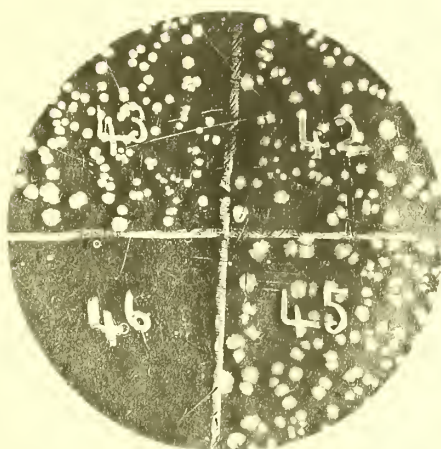


Fig. 5

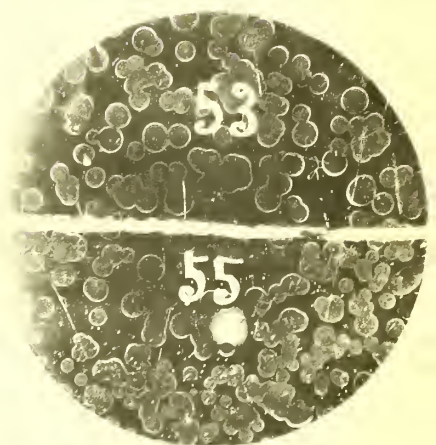


Fig. 6

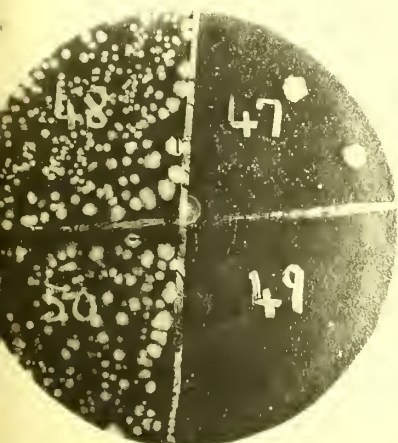


Fig. 7



Fig. 8

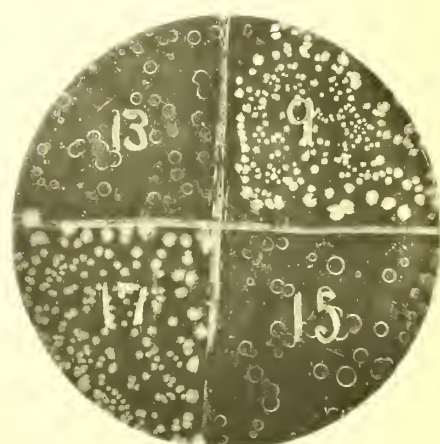


Fig. 9

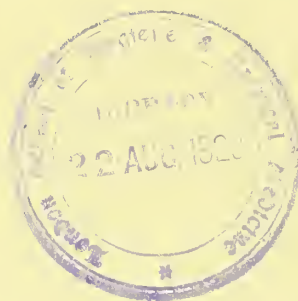


PLATE V.

- Fig. 1.—Div. 21, mud from Courtmaesherry (p. 101), cocci only. Divs. 22, 23, 24 correspond to oysters Nos. 1, 2, and 3 from Ilan River, Co. Cork (p. 103), and exhibit typical *Coli* colonies.
- Fig. 2.—Divs. 25 and 26 (latter destroyed by liquefaction) correspond to oysters Nos. 4 and 5 from Ilan River (p. 103), and show *Coccus* colonies only. Div. 27, water from the same place, showing typical *Coli*. Div. 28, mud from same place, pure *Coli*.
- Fig. 3.—Divs. 19, 20, and 21, oysters Nos. 4, 5, and 6 from Derryquinna, Kenmare River (p. 105). *Coli* on Nos. 19 and 20. No. 21 is negative. Div. 24 corresponds to mussel No. 1, from Glandore, result positive.
- Fig. 4.—Results of *Enteritidis* test applied to six oysters, water, and mud from Templenoe, Kenmare River. Compare Table on p. 105.
- Fig. 5.—Material from Roaringwater Bay, similarly tested. Compare Table on p. 104.
- Fig. 6.—Material from Derryquinna, Kenmare River, similarly tested. Compare Table on p. 105.
- Fig. 7.—Material from Glandore, Co. Cork, similarly tested. Compare Table on p. 103.
- Fig. 8.—Mussels, water, and mud from Woodstown, Co. Waterford, similarly tested. Compare Table on p. 141.
- Fig. 9.—Cockles, water, and mud from same place, similarly tested. Compare table on p. 141.

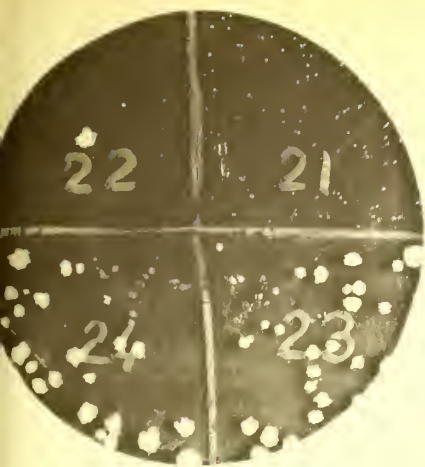


Fig. 1

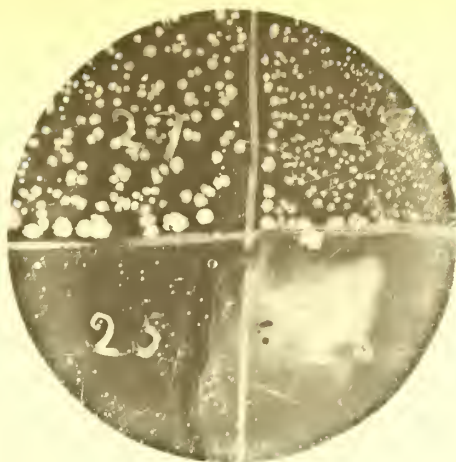


Fig. 2

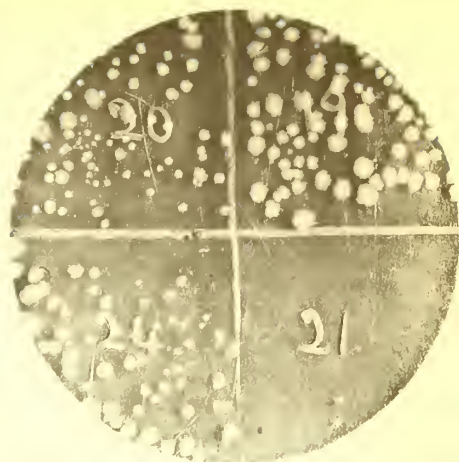


Fig. 3

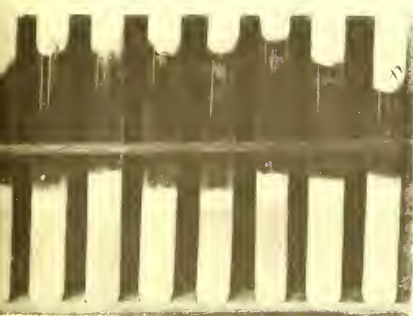


Fig. 4



Fig. 5



Fig. 6



Fig. 7

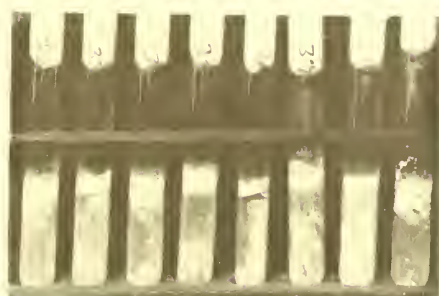


Fig. 8



Fig. 9

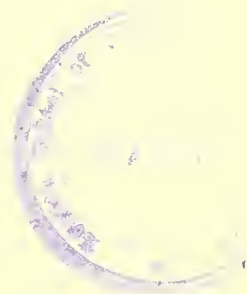


PLATE VI.

- Fig. 1.—Material from Derreen Beds, Kenmare River, tested for *Enteritidis*. Compare Table on p. 105.
- Fig. 2.—Material from Clonakilty Cockle Strand, tested for *Enteritidis*. The first, third, &c., tubes were allowed to develop without special precaution. The second, fourth, &c., were anaerobically incubated. The typical change has supervened as often in the one set as in the other. Each pair of tubes was of course inoculated with material from the same mollusc, &c. Compare Table and foot note on p. 102.
- Fig. 3.—The same series continued. Two oysters from Carrig Island at the right hand end See Table on page 111.
- Fig. 4.—Exhibits the results of comparing three methods for the isolation of *B. Coli*. The material used was an oyster from Tralee (No 3, p. 109). The left hand tube is from Klein's medium. It bears numerous liquefying colonies as well as some *Coli*-form ones. The turbid liquefied gelatine has run down and fills the bottom of the tube. The middle tube is from phenol-broth, and shows *Coli*-form colonies only. The right-hand tube is from M'Conkey's medium and shows some liquefying colonies just commencing to run down, as well as a large majority of *Coli*-form ones which have remained small owing to too thick insemination.
- Fig. 5.—Water from Tralee Oyster-bed tested for *Coli* by three methods:—M'Conkey on the left, phenol-broth in the middle, Klein to the right. The first shows *Coli* colonies in a state of purity; the second bears one or two liquefying colonies in its lower part; the third bears a relatively large number of liquefying colonies, the liquid from which fills the bottom of the tube.
- Fig. 6.—Mud from the Tralee Oyster-bed tested by the same three methods:—M'Conkey to the left, Klein in the middle, phenol-broth to the right. Pure *Coli* in the first and last, whilst there is an admixture of liquefying germs in the middle tube, and a small amount of turbid liquid in the bottom.
- Fig. 7.—Very dilute suspension of human faeces similarly tested for *Coli*—phenol-broth to the left, M'Conkey in the Middle, Klein to the right. Pure *Coli* in all.
- Fig. 8.—Four oysters from Tralee tested for *Enteritidis*. Positive results in all.
- Fig. 9.—The fifth oyster (to the left), mud (in the middle), and water (to the right), from Tralee (p. 109). Typical results from the first and last—doubtful from the second.



Fig. 1

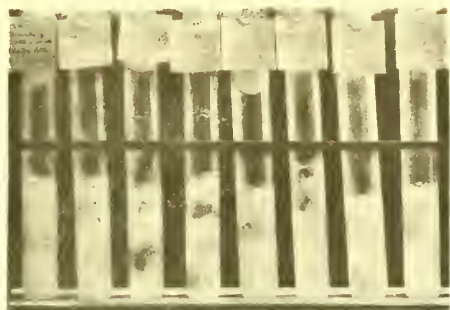


Fig. 2

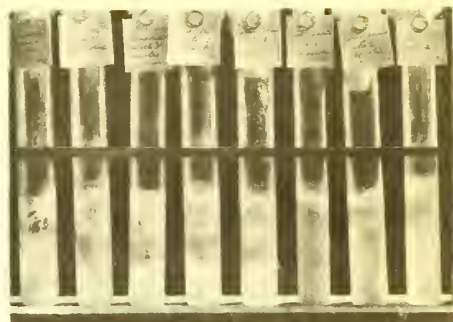


Fig. 3

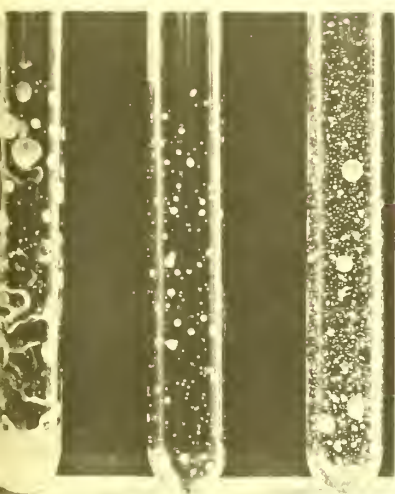


Fig. 4

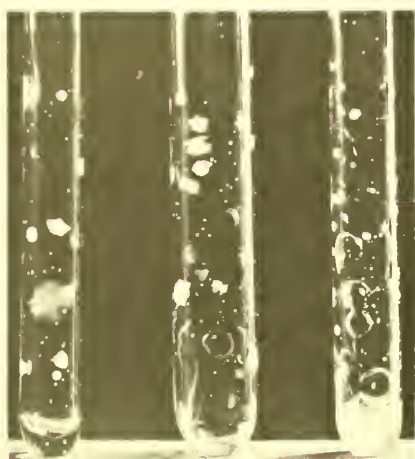


Fig. 5

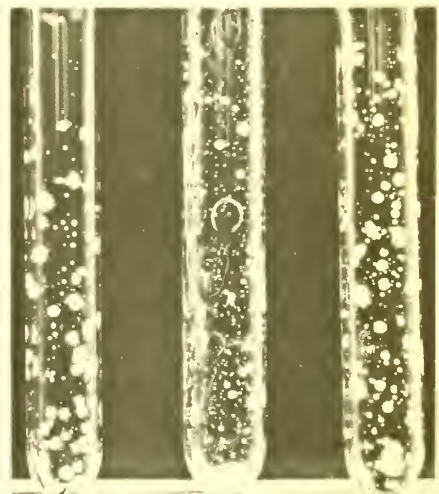


Fig. 6



Fig. 7

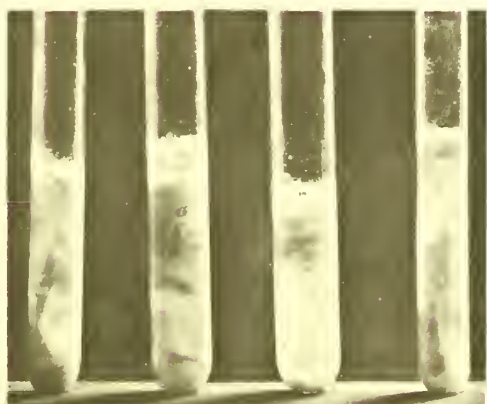


Fig. 8

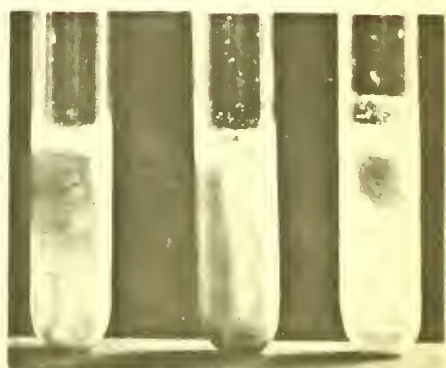


Fig. 9



PLATE VII.

- Fig. 1.—Shows the behaviour in neutral-red-agar and litmus-lactose-agar of *Coli*-form organisms obtained from Tralee oysters by fermentation-tube method as contrasted with that of a similar organism obtained from the same material by the phenol-broth method. The four tubes on the left are neutral-red-agar-shake-cultures. The first three appear dark owing to the unchanged colour of the neutral-red. The fourth looks pale owing to the neutral-red having been changed to a fluorescent yellow. The first three were inoculated with *pseudo-Coli* obtained by the fermentation-tube, the latter with true *Coli* obtained by the phenol-broth method. The four tubes to the right are litmus-lactose-agar shakes. The first three show paleness due to partial reduction of the litmus-colour in the lower part, darkness corresponding to reddening of the medium above, and a very moderate gas-evolution represented by the clefts in the column of medium. They were inoculated with *pseudo-Coli* obtained by the fermentation-tube method. The right-hand tube exhibits the behaviour of genuine *Coli* obtained from Tralee oyster No. 3, by the phenol-broth method. The column of medium is quite disrupted by vigorous gas evolution, and its colour save at the top completely discharged by reduction.
- Fig. 2.—Material from Carlingford tested for *Coli*. Divs. 10 and 12 correspond to oysters 2 and 4 from the foreshore near Ballyonan House (see Table, p. 124). They bear excessively minute streptococcus colonies, which appear clearly in the negative, but have lost much of their distinctness in the process of reproduction. They can be seen with a good hand lens. Div. 16 is the result of testing the mud from the same place for *Coli*, and bears similar streptococcus colonies, the appearance of which under a low power is seen in Fig. 9 on this plate. Div. 19 shows peculiar sunken-in yellow colonies which are not *Coli*-form. It corresponds to oyster 3 from Drummullagh (p. 124).
- Fig. 3.—Divs. 33, 39, and 40 represent the result of the *Coli* test as applied to material from McDonald's Layings, Newry River (p. 125). Div. 33 corresponds to oyster No. 1. It is thickly covered with streptococcus colonies. Div. 39 corresponds to the water, it bears typical *Coli* colonies. Div. 40 corresponds to the mud from the same place. It is studded with minute streptococcus colonies which, unlike those on Div. 33, are beginning to coalesce from liquefaction.
- Fig. 4.—Divs. 44 and 45 correspond to oysters 4 and 5 from Hardy's Beds, Newry River (p. 125). The colonies on the former are doubtfully *Coli*-form in appearance and were proved to be *pseudo-Coli*. On Div. 45 there are typical *Coli* colonies, and also on Div. 47, which is from the water taken at the same place.
- Fig. 5.—The top and bottom Divs. represent the result of the *Coli* test as applied to the water from the layings at Moyne Pool, Killala, Co. Mayo (p. 116), by the ordinary 1 cc. method (=Div. W.P., below), and by the 50 cc. flask-method (=Div. W.F., above). The latter shows large typical *Coli* films, whereas the former shows only doubtful colonies. The middle Div. (M.F.) was done with the mud from the same place, and shows typical *Coli* colonies.
- Fig. 6.—Four oysters from Glengariff Beds, Co. Cork (p. 104) tested for *Coli*. Typical *Coli* was obtained from all four divisions. Nos. 2 and 3 do not appear very typical, but this is due to overcrowding of the colonies.
- Fig. 7.—The two remaining oysters (=Divs. 5 and 6), the water (=Div. 7), and the mud, all from Glengariff, tested for *Coli*. Typical *Coli* on all—only one colony of *Coli* on No. 8.
- Fig. 8.—Mud from the estuary of the Ilan River, Co. Cork (p. 103), tested for *Coli*, but showing only *Streptococci*.
- Fig. 9.—Low-power (Leitz obj. 3, oc. 1) micro-photograph of *streptococcus* colonies from the mud of the layings near Ballyonan House, Carlingford Lough. The peculiar "nucleated" appearance is well seen.

PLATE VII.

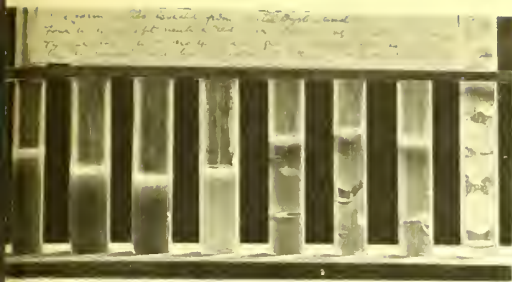


Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5

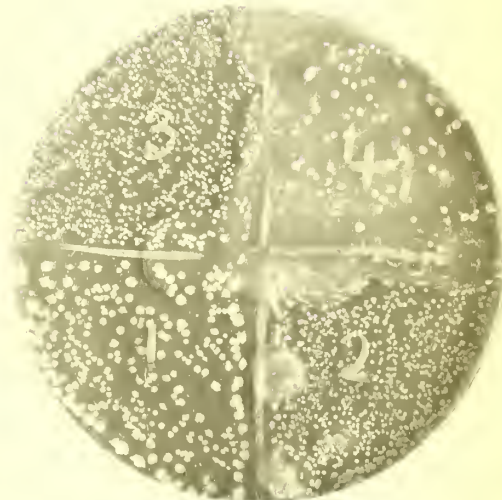


Fig. 6

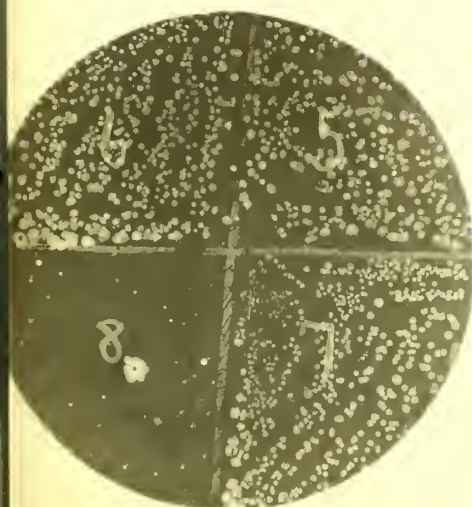


Fig. 7

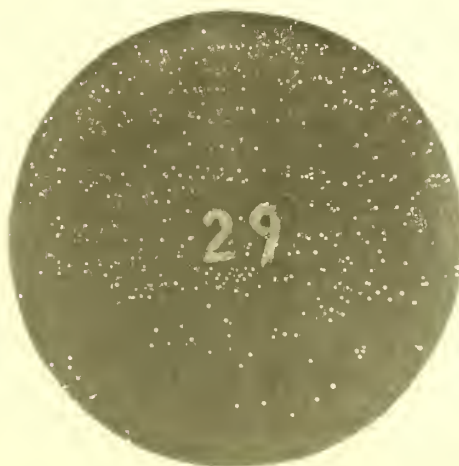


Fig. 8



Fig. 9



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No. 1216

DUBLIN CASTLE,

20th *January*, 1904.

SIR,

I am directed by the Lord Lieutenant to acknowledge the receipt of your Letter of the 19th instant (12 M/1904), and enclosed copies of the "Report on the Shell-fish Layings on the Irish Coast, as respects their Liability to Sewage Contamination." The necessary steps will be taken for presentation to Parliament.

I am,

Sir,

Your obedient Servant,

(Signed), J. B. DOUGHERTY.

The Secretary,

Local Government Board,

Dublin.



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